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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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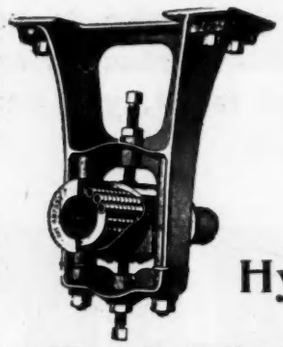

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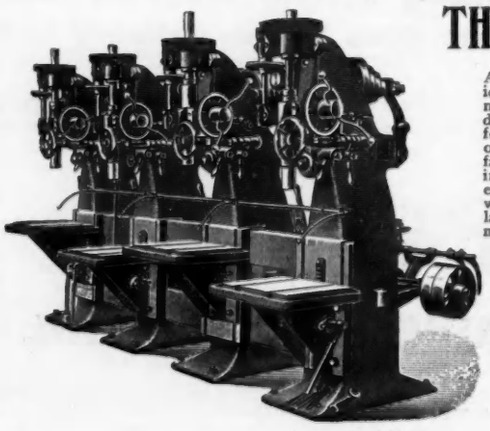

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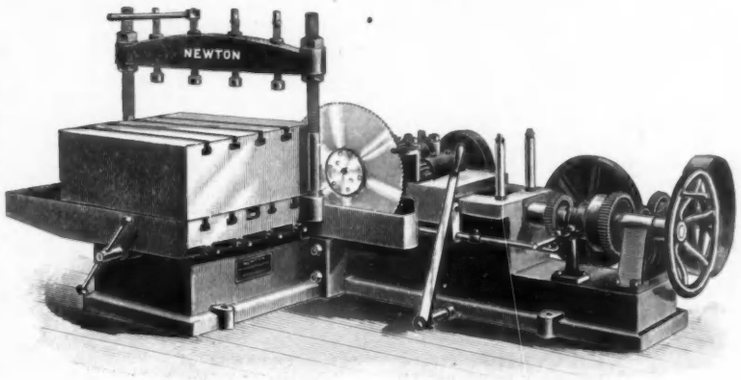

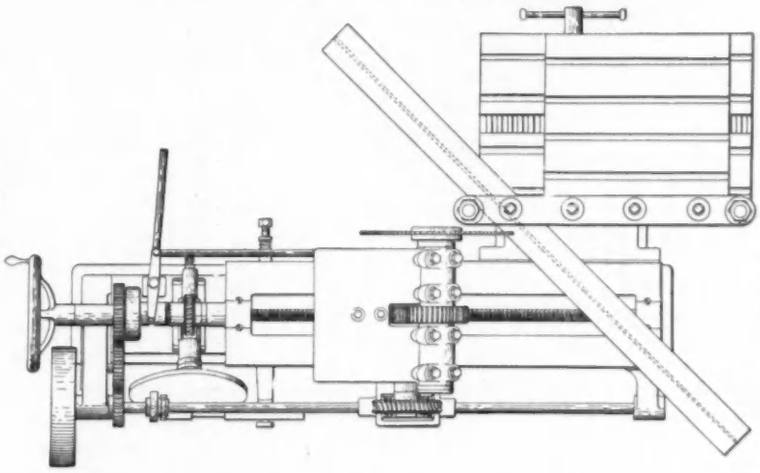

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Newton Machine Tool Works, Inc.,

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Help Wanted.

For many years we have been disposed to consider our column of Help Wanted advertisements as one of the surest indications of the state of prosperity existing in the machine building industries, and, from this point of view, the growth of the number of inquiries of this kind during the past two years is of interest. It may be fairly assumed that ordinarily an advertisement of this kind indicates that the help needed cannot be found at home, and that the advertiser has exhausted the resources of personal knowledge and direct inquiry. On this account the effect of increased prosperity on the number of inquiries is somewhat slow in making itself felt, but, on that account, it is all the more a sure indication of the state of activity.

The present revival of activity did not show itself until 1897 was well advanced, and for purposes of comparison it is desirable to go back to the beginning of that year. Moreover, there is usually a tendency for this class of advertisements to follow the seasons and to drop off during the summer. On this account it is necessary to compare the figures season by season. The following table shows the number of Help Wanted advertisements published by us per issue of the paper and for each of the four quarters of 1897 and 1898, and for the three quarters of 1899 which have passed. These figures are obtained by dividing the total number of inquiries for the quarter by the number of issues for the quarter, the figures given being thus an average for the period to which they belong:

	1897.	1898.	1899.
First quarter	6	9.1	11.6
Second quarter	6.5	9.8	13.9
Third quarter.....	4	8.4	17
Fourth quarter....	6.3	10.1	

It will be observed that while during 1897 and 1898 there was a marked falling off during the third quarter, there has been no such decrease during 1899, but, on the contrary, an increase. This agrees with the generally reported fact that there was this year no such slackening of business during the heated term as usually takes place. It will be seen that the number of inquiries for the first two quarters of this year is approximately double the number for the corresponding quarters of 1897, but that for the third quarter the ratio is over four to one. It will be interesting to note the number of inquiries for the last quarter of the year and see whether it compares with those for the first and second quarters as in other years, or whether it shows the usual increase over the third quarter. Should it do the latter it would certainly indicate a phenomenal state of activity in the industries which we represent. It is also interesting to observe the manner in which the figures for 1898 stand midway between those of 1897 and 1899.

The case is really stronger than these figures indicate. In numerous cases of late these inquiries have called for a "number of skilled mechanics," "first-class lathe, planer and vise hands," "first-class machinists," "machinists and tool makers," "four draftsmen," etc., and in other ways have shown the need of more than one man to each inquiry. Going back to the early period of the table, the inquiries were almost invariably for one man to fill some special position. Could the number of men thus advertised for be known, it would give a still more favorable appearance to the table, but, taking it as it is, it can only be looked upon as a gratifying evidence of the increased prosperity which the industries of the country are enjoying as compared with two years ago.

Liquid Air and Its Promoters.

Liquid air is nearly colorless, but its taste is becoming nauseating. It is not at present altogether pleasant to talk about it, but it seems to be necessary to do so. We have presented to our readers, as the occasion has arisen, most of the known and authenticated facts concerning it, and we have remarked more than once that no one yet knows very well to what practical uses it may be extensively put. In this, it seems we have been wofully mistaken. The professional promoters have found a use for it, and are working it industriously. As the "Engineering News" remarks, "The liquid-air industry is in a very *promising* condition at present."

Extravagant and utterly unwarranted promises are now the most insistent evidences of liquid-air interests. The American Liquid Air Company, of New York, nominal capital $10,000,000; the Consolidated Liquid Air & Power Company, of Boston, capital $10,000,000, and the Liquid Air, Power & Automobile Company, of Boston, are loudly advertising their stock for sale, have gorgeous offices with full staffs of employees, from which they are pouring forth floods of pamphlets and prospectuses which make the most absurd claims for liquid air and the most extravagant assertions as to what they are going to do with it; but we have not as yet the slightest documentary or presumptive evidence that either of these companies has ever either produced or employed any liquid air, or has any apparatus for the purpose. Each company is claiming to hold patents which give it a practical monopoly of the entire business, but no information is given as to what the patents are. The gullible public is buying more or less of the stock, but what the stock represents is something intangible and invisible.

It could scarcely be that three such companies could be actively engaged in the same business without developing considerable rivalry, and the results of this rivalry are likely to be that they will begin to tell the truth about each other and their business. In fact, we have already from this source one of the best statements we have yet seen of the actual possibilities in the use of liquid air, either for refrigeration or for the development of power. One of the Boston companies furnishes the truth-provoker. It says in its prospectus:

"A single gallon [i. e., liquid air] will perform wonders in an ordinary city home. A tumblerful dipped out and placed in the ice-chest will maintain a temperature of

zero in the refrigerator for twenty-four hours. A quart of it placed in the ventilating apparatus will keep the temperature of the whole house at 60 degrees during the hottest summer day. The remainder of the gallon, put into the proper motor, with an electric-dynamo attachment, will generate enough heat to do the cooking, run the electric lights, warm the water for the bath, and in the winter heat the entire house by electric radiators. Its application as a medicine is full of marvelous possibilities."

And here follows the truth as written by the president of the New York company. It is evidently written by a man who knows what he is talking about, and those who wish to know the refrigerative or power-developing possibilities of liquid air would do well to study it:

"That this passage is a tissue of monstrous and barefaced lies may be easily demonstrated. The refrigerating power of any substance is measured by its capacity of absorbing heat from the surrounding atmosphere and objects near at hand. And when we wish to express heat in terms of quantity we take as our standard what is known as the British thermal unit; that is to say, the amount of heat sufficient to raise the temperature of one pound of water by one degree Fahrenheit. Now, it has been found by experiment that one pound of ice requires 144 heat-units in order to become completely melted. It is then in the form of one pound of water at 32 degrees, and can absorb 18 additional units in rising to 50 degrees Fahrenheit. Consequently, when ice is used to cool the interior of a refrigerator to 50 degrees Fahrenheit, it has a cooling power of 162 units per pound. In comparison with this let us see what cooling power is possessed by a pound of liquid air. The best scientific authorities are agreed that the heat absorbed in converting one pound of liquid air into ordinary gaseous air is 144 units; and the product then has a temperature of about 312 degrees below zero. A pound of gaseous air, however, takes very much less heat to raise it one degree than does a pound of water; the proportion being only 238 to 1,000. If then, we desire to know how much heat a pound of air will absorb in rising from 312 degrees below zero to 50 degrees above, we have to multiply 362 by 0.238. This gives 86.156 units, which, added to 144, makes 230 as the entire cooling power of one pound of liquid air. Accordingly, one pound of liquid air, considered as a refrigerant, is theoretically equal to 230 ÷ 162, or 1.42 pounds of ice. But as the loss by evaporation in moving and handling liquid air is very great compared with the analogous loss sustained by ice, we are bound to regard the two substances as being practically equal in refrigerating power, weight for weight. A pint of liquid air weighs somewhat less than a pound, and is thus not more effective than a pound of ice in cooling power. A tumblerful is the equivalent of about half a pound of ice. Yet, the before quoted prospectus says it will maintain a temperature of zero in a refrigerator for twenty-four hours!

"A house of moderate size contains about 1,000 pounds of air. To reduce its temperature by one degree Fahrenheit requires the absorption of 238 heat units. A quart of liquid air is rather less than two pounds in weight, and if used to reduce temperature to 60 degrees, has a total theoretical cooling power of about 450 units. It, therefore, would not lower the temperature of a house full of air by even two degrees; and if we consider that the air in a house is being continually changed, the effect of a single quart of liquid air gradually evaporated would be altogether inappreciable. Yet the precious prospectus tells us that 'a quart of it placed in the ventilating apparatus will keep the temperature of the whole house at 60 degrees during the hottest summer day'!

"Heat, as everyone knows nowadays, is transformable into mechanical power. The force exerted by a steam engine is derived from the heat in the furnace under the boiler. One heat unit if entirely converted into mechanical power will raise a weight of 772 pounds through the space of a foot. Now, liquid air has no power in itself. It is merely a vehicle or mechanism by means of which heat may be converted into mechanical power; and its value in this respect is measured by the quantity of heat it can thus transform. It accomplishes the conversion by expanding against a piston in a cylinder; and a gallon of liquid air in thus expanding to 800 gallons of gaseous air at ordinary atmospheric pressure and temperature, will develop a mechanical power of about 1,500,000 foot-pounds. One horse-power is 33,000 foot-pounds per minute. We see, therefore, that a gallon of liquid air is a mechanism by which we may exert a force of 1 horse-power for forty-five minutes, if we have a corresponding supply of heat available. We must find some way of warming the air, so as to gasify it and raise it to atmospheric temperature, and we must also supply it with a quantity of heat equivalent to 1,500,000 foot-pounds of work. In a steam engine it is not the steam itself that does the work. The steam is a mere carrier for the heat generated in the furnace. In like manner liquid air used for power purposes is a mere carrier of heat. It has, however, an advantage over steam. It does not necessarily require a special supply of heat. Owing to its low initial temperature, the vessel that contains it and the surrounding atmosphere, together with all contiguous bodies, are very hot by comparison, and thus serve as a costless furnace. But this furnace is of very slow operation; so slow, indeed, as to be unavailable for practical purposes. A thousand candles may perhaps be capable of generating as much heat as 100 pounds of coal; but a steam engine driven by the flame of a single candle would not be of much use, even though the flame might be kept burning from year's end to year's end. Assume, however, that this difficulty does not stand in the way and that by some ingenious method the atmospheric heat is transmitted with practical celerity to the liquid air. Five and one-half pints (i. e., a gallon after deduction of a tumblerful and a quart) of liquid air used in a motor with full theoretical 100 per cent. efficiency will only give us a force of 1 horse-power exerted for thirty-one minutes, or, say, one-tenth of a horse-power for five hours. And yet we are told by the prospectus Munchausen that it 'will generate enough heat to do the cooking, run the electric lights, warm the water for the bath and in the winter heat the entire house by electric radiators'!"

Machine Tools in the French Reciprocity Treaty.

Full information regarding the recently arranged reciprocity treaty with France is not yet obtainable, but according to a list of articles published in the New York "Journal of Commerce," machine tools, along with horses, stallions, geldings, mares and colts, and other things, mostly agricultural products, are excluded from the benefit of the French minimum tariff.

It is hard to perceive any good reason why this should be so, and the only reason, good or bad, that we can think of is that there is a concrete and active opposition in France to the importation of American tools—an opposition stimulated mainly by those who make tools there, and who mistakenly imagine that it would be a good thing for them if importations of foreign tools could be stopped. On the other hand, those in France who want to buy and use American tools and those here who want to make them for sale in France are not definitely united. They present no specific demands, and, as usually happens in such cases, here as well as in France, their interests are sacrificed to meet the demands of the few who think they know what they want, and do not hesitate to speak for it.

The treaty has not yet been ratified by the United States Senate, but, as we understand it, no modification is possible; the treaty as it stands must either be ratified or rejected as a whole.

An item is going the rounds of the press, which states that Switzerland is the only civilized country which is without a patent law, and, doubting the accuracy of this statement, we asked information of Mr. Carl Sulzer, of Winterthur, who informs us that Switzerland has had a patent law for a great many years; that this law is similar to the German law, and is working satisfactorily, the one principal difference being in regard to the

"verfahren" proceedings or methods of working, which in Switzerland cannot be protected in themselves, but only in the apparatus or machinery serving for the process.

Commercial Review.

NEW YORK, THURSDAY EVENING,
September 28, 1899.

MACHINE TOOLS.

Increasingly acute is the demand for machine tools. Stocks of machines are as if a cyclone had swept through them. Heavy tools of all sorts are tied up on order books for months and months ahead. The public is beginning to forget what radial drills and milling machines look like, and the premises on which a solitary planer may be found are in danger of a raid perilous to life and limb. When the dealer, overwhelmed with importunity of would-be buyers, seeks consolation from his accustomed manufacturers, he is likely to get scant satisfaction, and he is often compelled to turn a deaf ear to the customers he is so anxious to serve. In some lines of tools certain manufacturers might as well go out of business, so far as their being a factor in the present market is concerned.

Although no particular advances in prices of machine tools have lately come to our notice, there is every reason to believe that the upward movement has not ceased. Machinery values naturally are controlled more by the pig iron market than by anything else, and there is no reason to suppose that has exhausted its store of surprises. There has already been heard a remark about fifty-dollar pig iron, and although it may be a good many stages away from us at present, such a thing has been seen before now, and no man can prove that it will not be seen again. Be that as it may, we have heard of an order recently placed for tools for delivery during the winter and spring on a contingent price. The manufacturers were so apprehensive of the state of the raw material market and its influences upon machine tools that they were unwilling to accept the order unless they could protect themselves against sharp rises in values. This order was for thirty lathes of 14 to 30 inches.

A New York dealer in miscellaneous tools has just taken a little trip to call on the manufactories where he has outstanding orders. Among these orders is one for a lot of planers which he placed three or four months ago, and which he has agreed to deliver to customers next month. He finds that the manufacturer who was to build them is so tied up with work that he has not been able to do the first thing in their construction, and that it will take an additional ten months to get them ready. "Send us down fifty or a hundred men," says the manufacturer, "and we may be able to do something." The dealer referred to has not a single planer in stock, although he has orders let for fifty-five, some of which have been sold in advance, and some not. The shops he visited were destitute of stocks of tools, When a machine was seen standing around and our friend would essay to preempt it, the stated reply given him was, "It is sold already." The sorrows of the middleman in not being able to get orders filled as promised are alleviated by the absence of one trouble which might be the source of much embarrassment; customers do not cancel orders when tools fail to be forthcoming.

Motor vehicles are supplying a fairly active, though by no means sensational, source of demand for machine tools. Several sellers speak of this line of tool trade as good, though one thinks it not quite so active as it has been in the past. Quite a number of tools for this industry are going from Newark, N. J. The Newark Machine Tool Works are receiving orders for their horizontal boring mills for carriage engine cylinders, and Gould & Eberhardt have sold gear cutters, shapers, etc., for automobile work.

A call was paid yesterday at the works of Gould & Eberhardt, Newark, N. J., where market conditions, domestic and foreign, were found to be ruling as satisfactorily as hitherto. The works are being enlarged about 50 per cent. The firm has about three-quarters of a block of ground room, and their shop additions will give them in all a floor space estimated at 3½ acres. The new space is being filled up with tools chosen for their merits, irrespective of cost. It may be in fair running shape in a couple of months, but the improvements will probably extend over a longer period of time, as the firm is now considering the installation of an electric plant, and the adoption to a greater or less extent of the electric system of driving tools. The relative merits of the direct and alternating current apparatus are now being looked into. It may be mentioned that for the new electrically-driven plant of the C. W. Hunt Company, New York, an 80-inch Gould & Eberhardt gear cutter and some drill presses have recently been shipped.

The Newark Machine Tool Works are receiving a steady, active demand for their horizontal boring mills. An order has come this month from the Société Industrielle d'Electricité (Westinghouse system), of Havre, France, for four machines with 4-inch bar.

Mr. Rudolf Kirschbaum, manager of the German Garvin Machine Company, is again in New York, after having been looking about through New England with a view to buying tools for installation in the new factory. He visited Boston, Worcester, Nashua, Providence, Hartford, etc., and found manufacturers more filled with work and less in position to handle new orders than was expected. Consequently he transacted less business than he had anticipated, although we understand that some orders were let at that time, including contracts with the Putnam Machine Company and with P. Blaisdell & Co.

On behalf of a certain company which is taking up the automobile industry, Mr. Kirschbaum is finding occasion to investigate the progress made in America toward constructing a practical and satisfactory motor. Although the automobile craze may not have made as great headway in Germany as it has in France or England, the matter has been taken up mechanically by quite a number of firms. One of them builds a motor known as the Benz, and another is a Löwe interest. The industry is in an experimental stage, and a practical machine is greatly desired.

Mr. Kirschbaum referred to the Boer war as liable to become an important factor in the German tool market. While there does not seem to him to be much prospect that Germany will interfere politically, yet she would be considerably affected by disaster to the gold-mining interests, and thus all branches of business would be affected.

Mr. Kirschbaum will start this week for Philadelphia and other points. His nephew, Mr. Fritz Engels, technical manager of the German Garvin Company, is expected to arrive here about the 5th or 6th of October.

The Woods Motor Vehicle Company is the title of a concern recently incorporated under the laws of New Jersey, with a capital of $10,000,000, to manufacture automobiles. Its directorate contains some very substantial capitalists, including John W. Mackay, president of the Commercial Cable Company; W. Seward Webb and Sir William C Van Horne. Frederick Nicholls is president. The company, it is announced, has taken a factory in Chicago and proposes to establish another in the vicinity of New York. The intention is to have Canadian works also. It is stated that the company will start with a number of contracts taken over from the Fischer Equipment Company.

The consolidated electric lighting interests in New York have ordered of Thayer & Co. fifty-six boilers for their new power plant. These will be of the Babcock & Wilcox type, of 600 horse-power each or a little over, and will be constructed by the Aultman & Taylor Company.

CINCINNATI REPORT.

Demand in September seems to have been of larger proportions than during the months of July and August, and there is no indication that there will be any falling off during the remainder of the year. If it were so, all manufacturers here would have more than enough to do to fill what orders they have now on hand for the three months to come, whether they had any new orders or not.

The Buckeye Engine Company is rushed with business, and has some orders for

large engines, including one for a 2,000 horse-power cross-compound engine for the Indianapolis Street Railway Company, and another for two 3,800 horse-power tandem compound engines for the La Belle Iron Works, Wheeling, W. Va., and one 2,500 horse-power engine for the same company. A good many orders have been received for engines of 1,000 horse-power and upward.

Dietz, Schumacher & Boye have completed the additions which were being made to their plant, and have added a large number of new machine tools, improving their facilities very much. With the withdrawal of Mr. Dietz from the company the business will be carried on by the remaining partners.

The Bradford Mill Company is finding a continued growth in the demand for its machine tools and is keeping as large a force of men at work as its surroundings will enable it to.

HAMILTON REPORT.

Hamilton, Ohio, is a prominent manufacturing point, 25 miles from Cincinnati. It has two lines of steam railroad, which give it good shipping facilities to the East, West and South, and an electric railway joins it to Cincinnati. In the improvement of manufacturing interests throughout the country in the last two years this city has shared. The number of men now employed here in the manufacture of iron products is probably double the number at work three years ago. The Niles Tool Works now have 1,200 men against 400 at one time. A good number of men are working at night on their large machine tools. While they are having a fair amount of export trade, in which shipments are being made to all the important foreign countries, they are disposed to give more attention to their home trade, as being the more profitable to them. They are turning out some of the largest planers made in the country.

The Hooven, Owens & Rentschler Company has upwards of 350 men fully employed. It has a night force working on its orders for engines of 800 horse-power and upwards. While having a heavy demand for large engines, it prefers orders for the smaller sizes, as being more profitable business. In an offhand way it estimates that this year's trade is 50 per cent. better than that of 1897 and 1898.

The Bentel & Margedant Company, manufacturer of wood-working machinery, has found quite an increase in its business for this year over what it was during the corresponding months in 1898, and it has been keeping some 300 men employed. In one line it is just now a little off time for orders, and it is not having quite so much to do as at an earlier season.

The Long & Allstatter Company found that, up to 1899, 1892 was the most prosperous year it had known in its experience, but its business for this year bids fair to double anything it has ever done before. It has been doing a good export business, and inquiries and orders have come in every day. It is making shipments to Russia, France, Scotland, Japan and Germany, and a large one to Russia. Its home trade has very greatly increased, and it has been compelled to refuse many orders, since it cannot fill them so promptly as its customers desire. It has enlarged its foundry so it now covers 46 x 206 feet, giving capacity for double the former foundry output. It has put in two 30-ton cranes and added three new planers of large size, several new drills, lathes and other tools. The Johnston Steel Works have now in use in their plant in Loraine, Ohio, two large billet shears made by the Long & Allstatter Company, each weighing 200,000 pounds. The company has orders on hand which will keep it very busy for some time to come.

The Hamilton Machine Tool Company has recently added a new brick building. In addition to its present steam plant it is installing a 150 horse-power engine, a 700-light generator and new boilers. It has added several new machine tools, including planers, lathes and gear cutters. It has recently made large shipments of lathes to Germany, Sweden, Italy and Japan, and is now working on an order for lathes going to Milan, Italy. Its orders are increasing from day to day, furnishing employment to some 200 men, which force will be increased as may be needed, and it is running its works steadily 13 hours a day.

The Hamilton Foundry and Machine Company is a concern started here within the last three or four years. Having started in slowly, it has continued on, and has been favored with a fair volume of business, which has been enlarging as the months have passed by, and so far as known it is doing more this year than at any time since it has been in business. It keeps quite a good force of men at work on full time.

CHICAGO MACHINERY MARKET.

September sales of machine tools in the West were about equal to those of August or July, which means that they were phenomenally large. The month of September started in with moderate promise, but the last two weeks showed decided gains in the inquiries and transactions. And in this respect there is semblance of a reviving fall trade, if that statement may be made on the heels of an unusual summer business. The buying is not of a large, generous, whole-souled nature. Orders are rather grudgingly given. They represent the barest needs of the manufacturers who are buying. Part of this closeness in making purchases is due to the higher range of prices, users of machinery expressing some doubts as to the permanence of present values, and partly to the fact that the buyers put off till the last moment the proposed purchases. The need of a large planer or other tool is not anticipated. The user waits, perhaps, until he has booked a large contract which requires it, then buys, expecting a delivery promptly. In this he is disappointed. From one to six months is his period of waiting.

Gasoline engines are having a boom in the threshing districts of the Northwest, where they are said to be rapidly displacing the old steam engine. They have been used for this purpose for a year or two, but the inroads made this season are more remarkable than at any previous time. An Indiana producer one day last week shipped seven carloads of gasoline engines to one point in North Dakota.

The Woods Motor Vehicle Company, of this city, has bought a fairly large number of tools from J. B. Doan & Co. and other sellers. The Plano Manufacturing Company, of West Pullman, has also been a good buyer. Machine shops, car works, railroad shops and engine and boiler shops are all in the market for considerable machinery. Work in boiler shops is, for the present, is deranged by a strike.

Quotations.

NEW YORK, Monday, October 2.

Iron — American Pig, tidewater delivery in 1900:—

Pennsylvania Irons:	
No. 1 X foundry	$23 60 @ $24 00
No. 2 X foundry	22 60 @ 23 00
No. 2 plain	21 60 @ 22 00
Alabama Irons:	
No. 1 foundry	22 75 @ 23 50
No. 2 foundry	21 75 @ 22 50
No. 3 foundry	21 00 @ 21 50
No. 1 soft	22 75 @ 23 25
No. 2 soft	21 75 @ 22 25
Foundry forge	19 50 @ 20 50

The market is very irregular, and some furnaces ask considerably more than the above prices.

Bar Iron — Base sizes — Refined, mill price on dock, 2.20 @ 2.35c.; store price, 2.60c., upward; common from store, 2.50 @ 2.60c.

Tool Steel—Base sizes. Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, in small lots, 2.90 @ 3.25c.

Cold Rolled Steel Shafting—Base sizes —From store, in small lots, 4 @ 4.25c.

Copper—Carload lots, Lake Superior ingot, weak at 18½c.; electrolytic, 17⅝c.; casting copper, 17⅜ @ 17½c.

Pig Lead—Carloads, 4.62½ @ 4.65c.; wholesale lots, 4.60c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 32½ @ 32⅝c.

Spelter—Prime Western in carload lots, 5½ @ 5⅝c.

Antimony—In cask lots or over, Cookson's, 11c.; Hallett's, 9⅞c.

Lard Oil—Prime city, present make, ice-pressed, 43 @ 46c., according to brand and quantity in lots from one barrel upward.

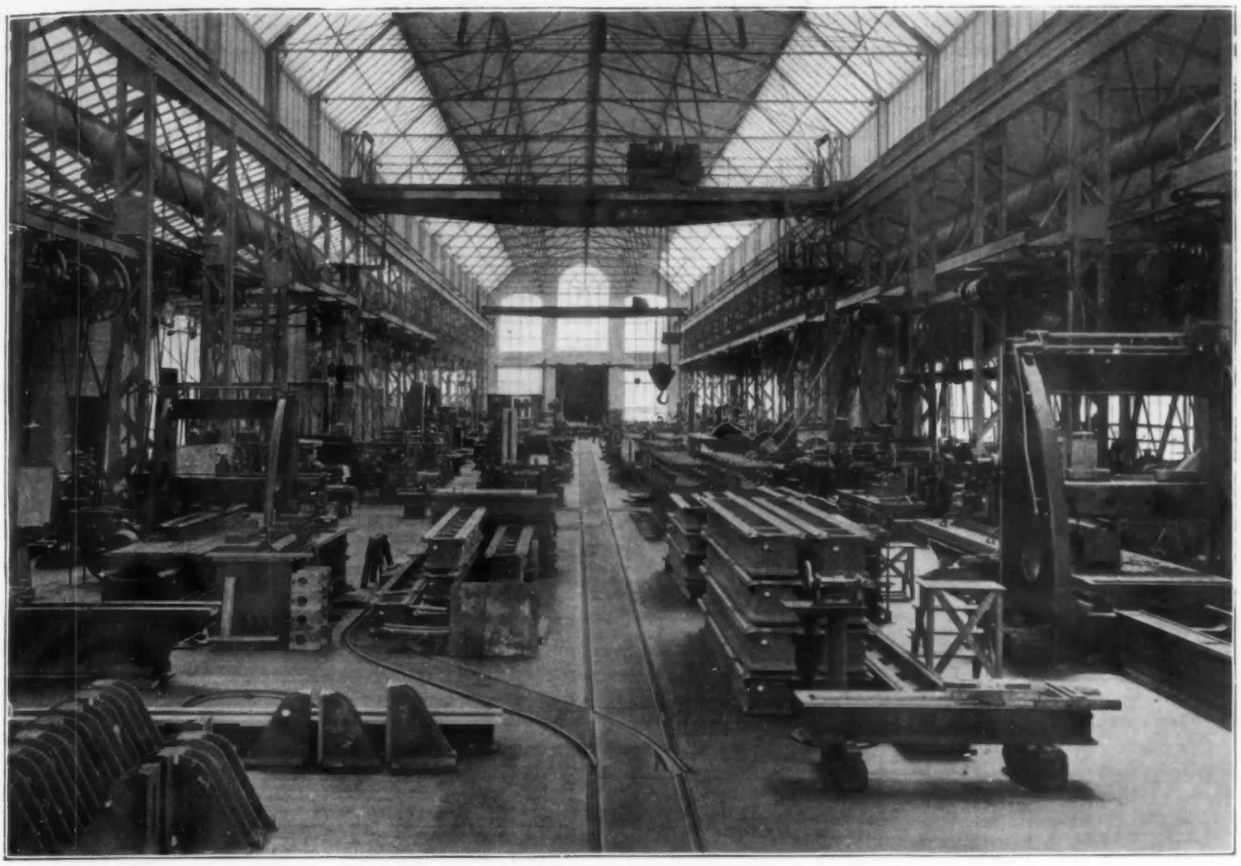
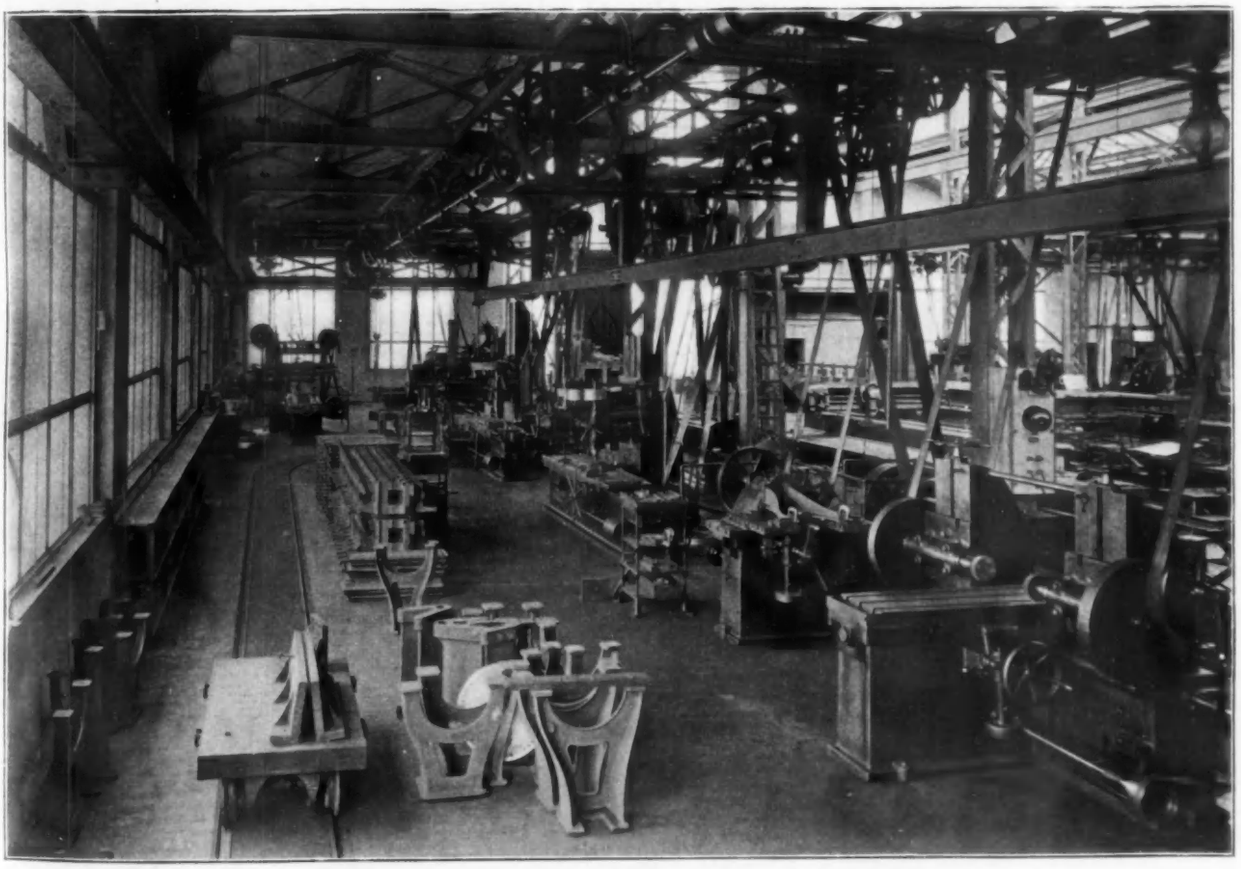


FIG. 7. MAIN HALL OF MACHINE SHOP.



HEAVY MILLING DEPARTMENT.

The New Work Shops of Ludw. Loewe & Co., in Berlin—II.

THE MACHINE SHOP.

The machine shop is the largest of the group of buildings. The main hall, an interior view of which is given in Fig. 7, is 368 feet long. The central portion of this room, which is covered by traveling cranes, is 46 feet wide, and on each side of this is a bay 28 feet 3 inches wide, making the total width of this floor 102 feet 6 inches. In addition to this is the three-story portion, the main part of which is 311 feet long, 34 feet 6 inches wide, with three wings, each 51x54 feet 6 inches. The total floor space of the building, including the cellar, is about 112,600 square feet, and it has a capacity for the employment of about 600 men.

At Fig. 8 is a cross-section of the building upon the line designated in Fig. 1, which is reproduced for convenience of reference. In the design of this building the idea has been to arrange the various divisions and subdivisions of the work in such a manner that each may have its distinct territory assigned to it and yet each be so arranged as to be convenient to the main hall and so that material and finished or partly finished parts may progress in an orderly manner through the

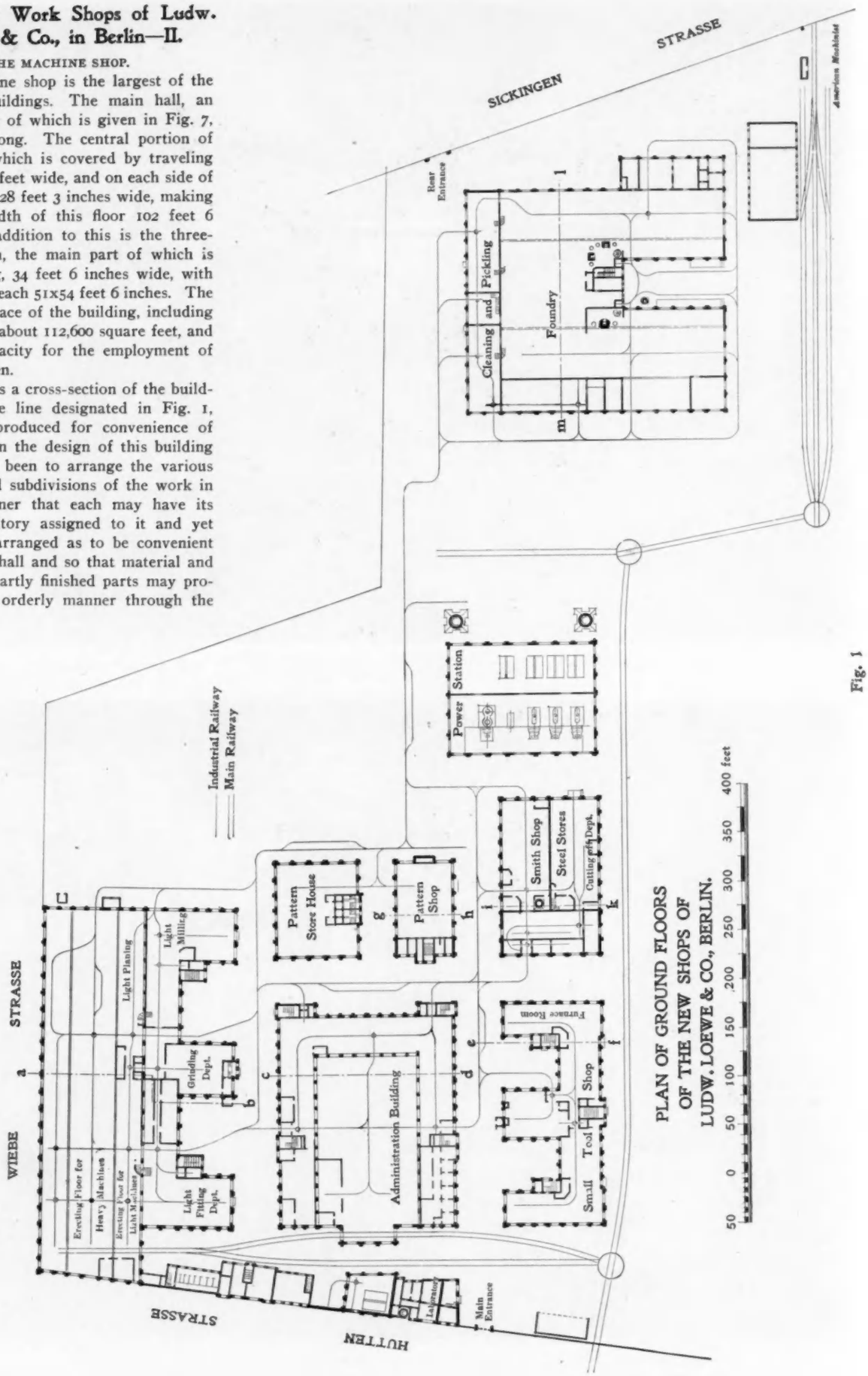


Fig. 1

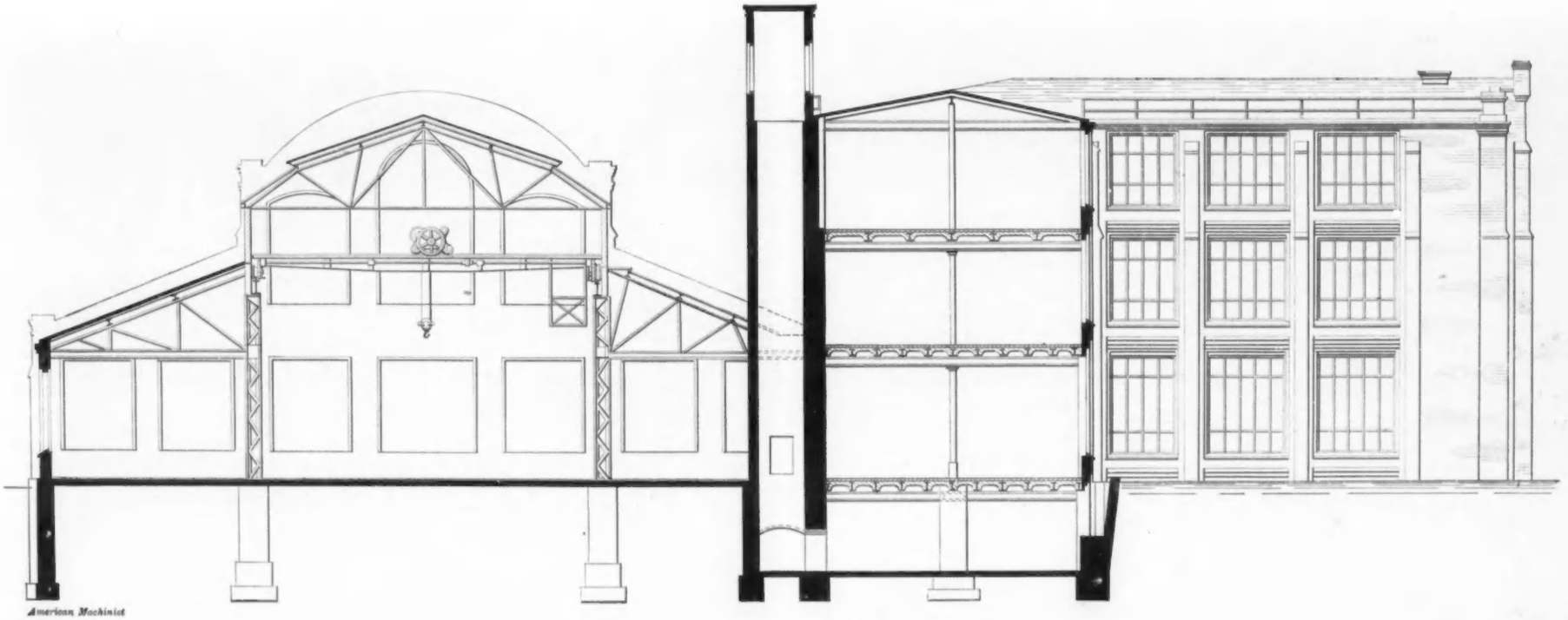


FIG. 8. SECTION OF MACHINE SHOP THROUGH *a b*.

shop without interfering the one with another.

All material enters the machine shop at the north or rear end, the lines representing the location of the "Hunt" system of industrial railways (Fig. 1), showing how it is conveyed there from the foundry floor or from the cleaning and pickling room of the foundry, or from the smith shop. These lines also show how the material may be delivered at any required part of the building and how, when it has progressed through the shop to the other end, it is then convenient to the lines of the main railway, which cross the shop near its south or front end, and also to the line of "Hunt" track which leads to the administration building and across its storeroom floor.

Light castings or forgings which are to be planed or milled stop near the entrance to the building; the light planing department occupying the corner of the main machine shop floor, designated in Fig. 1, while the light milling is done upon the ground floor of the adjoining wing, these two departments being handled together, since the object of both is the production of plane surfaces, and in some cases the same piece is both planed and milled, while other pieces are either wholly milled or wholly planed, according to circumstances. Most of the light milling is done on machines of the company's own make, while the heavier milling is done by American machines built by various makers.

All planing up to the limit of that which can be done on a 24-inch planer is classed as "light planing," and in both the light planing and light milling departments work is put through in as large lots as possible and tooled to size by means of standard gages and by the assistance of jigs and special fixtures.

The grinding department (see Fig. 10) occupies the ground floor of the middle wing. This is equipped mainly with Brown & Sharpe grinders for cylindrical and plane surfaces, the company being evidently thoroughly alive to the advantages of this modern method of finishing work.

Near the grinding department is the storeroom for small parts, screws, etc., in which are kept all the smaller parts of machines which can be standardized, made to gages and kept in stock.

The light fitting department occupies the south wing ground floor, where it is convenient to the main erecting floor, and in this light fitting department lathe-carriage aprons and all such compound parts of machines as can and ought to be separately assembled are put together, and are then near the point at which they are used in erecting the complete machines of which they form parts.

The heavier milling, planing, boring, etc., is done upon the remainder of the main hall floor, as is also the scraping and fitting of the heavier portions of machines, every piece, so far as possible, getting nearer to the erecting floors as it moves from one stage to another towards completion. The chief inspector's room is at this end of the hall, and it is the practice of the shop to inspect parts during their

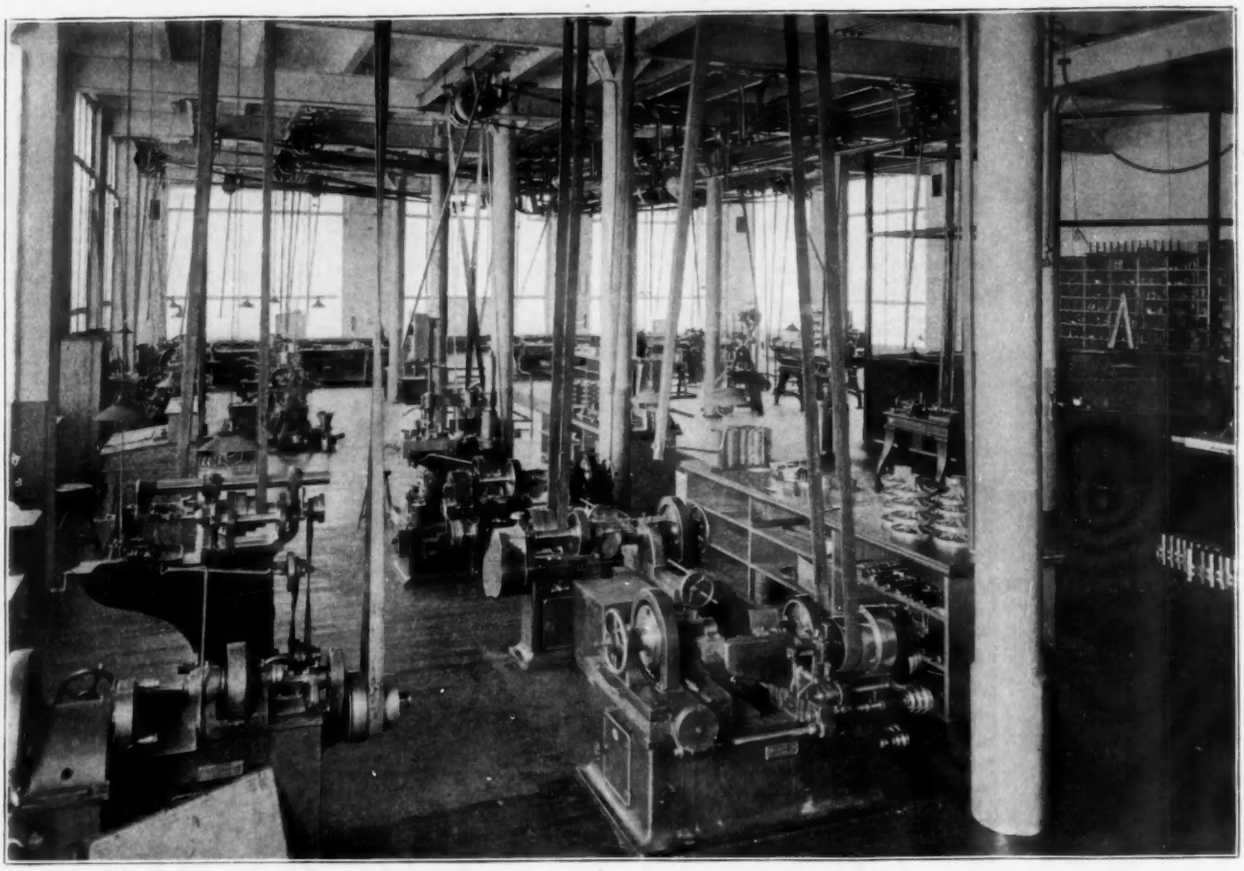


FIG. 9. VIEW IN LIGHT MILLING DEPARTMENT.

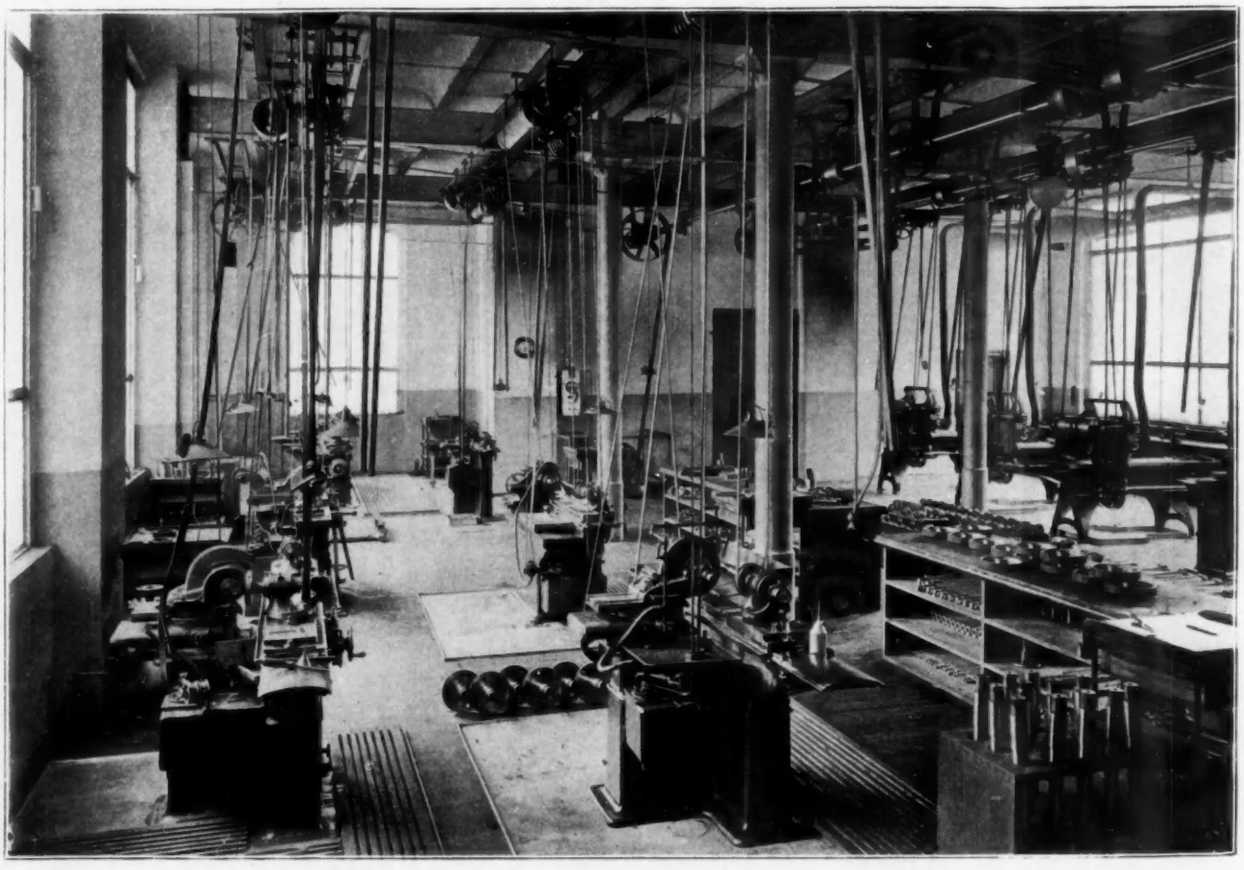


FIG. 10. GRINDING DEPARTMENT OF MACHINE SHOP.

FIG. 11. LIGHT FITTING DEPARTMENT OF MACHINE SHOP.

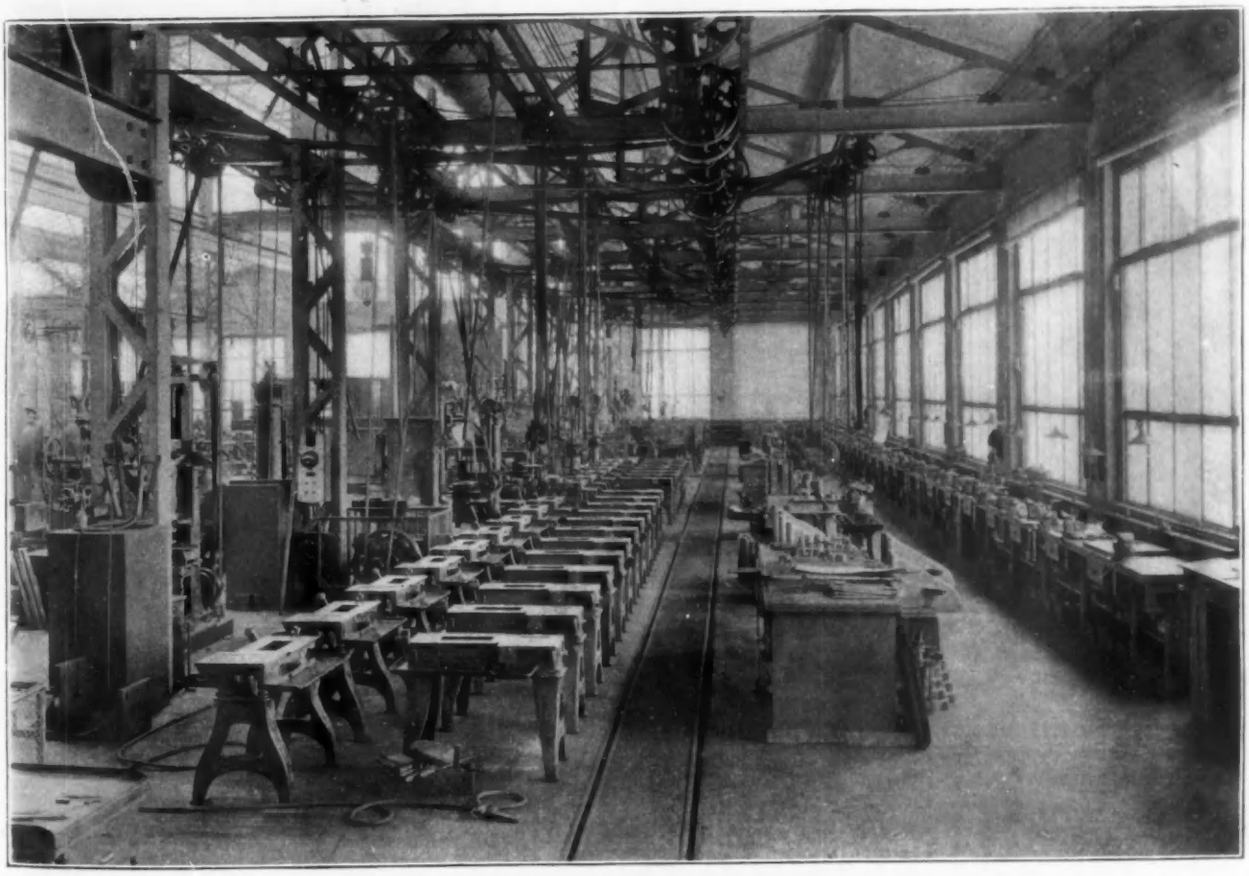


FIG. 12. PORTION OF ASSEMBLING ROOM FOR LIGHT MACHINES.

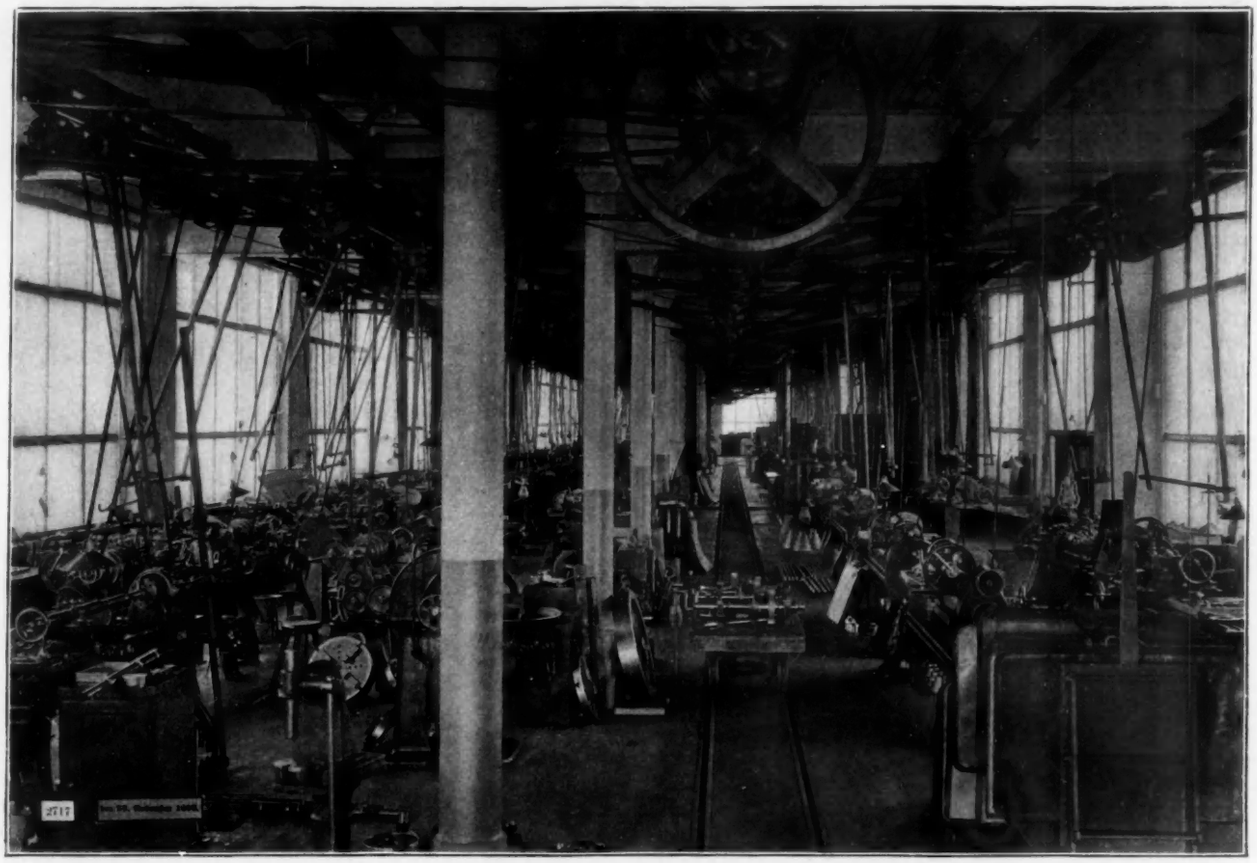


FIG. 13. TURNING DEPARTMENT, MACHINE SHOP.

FIG. 14. VIEW IN CHUCKING DEPARTMENT OF MACHINE SHOP.

progress through the shop and then inspect also the machine as a whole after it is finished.

The entire length of the second floor connecting wing is occupied by the turning department (Fig. 13), and adjoining this in the north wing is the chucking department, which is equipped with Gisholt and other chucking machines, and here all hollow spindles are bored. This department is directly over the light milling department, and is the beginning of all cylindrical work that does not go directly to the turning department, the grinding and other subsequent operations which are performed upon chucked and turned work carrying them constantly forward toward the assembling and erecting end of the building, this movement being parallel to that of the planed and milled work on the floor below. Other features of the machine shop will be shown next week.

(To be Continued.)

Secor's Kerosene Burning Motor.

All prime movers are interesting in the highest degree, as they are of the utmost importance to the progress of humanity from savage life towards the best possible existence. All real advances towards better living come from better machinery, and the vast improvements in machines which have been made in the century now ending were made possible almost wholly by the existence of the steam engine; without that prime mover at our command but few of the other mechanical advances could have had a commercial demand for their existence, or could have been made in themselves commercially profitable, and hence would never have come into great use.

Just now we are beginning to fully recognize the value of another prime mover in the form of the internal combustion motor, which stands to-day almost exactly where the steam engine stood a hundred years ago, although, having the steam engine as a familiar and universally accepted prime mover, the gas engine is not the startling and world-revolutionizing novelty that the steam engine was in the year 1800.

In the steam engine the fire burns continuously, while in the internal combustion motor a new fire is lighted, burns and is extinguished, for each working stroke of the motor. Hence, as it is highly desirable for most purposes that the action of any prime mover should be rapid, so that the motor shaft may turn at a high speed, internal combustion engine makers naturally turned to the most easily lighted and rapidly burning fuels they could find, and used various combustible gases mixed with a proper proportion of air for the cylinder charge.

Up to the present time it has been supposed that where the entire fuel charge of an internal combustion engine was to be simultaneously fired, the fuel must be in the form of gas, so that it could be mixed with air as rapidly as is needful; and gasoline, which very easily assumes the form of gas, natural gas and producer gas are among the fuels most often used in internal combustion engines.

Kerosene oil is a cheaper fuel than any of the above, and many attempts, more or less successful, have been made to burn kerosene in internal combustion motors, because it is not only cheap, but is everywhere obtainable and is both convenient and safe to handle.

The following table shows the work, expressed in foot-pounds, which may be obtained from various sources of power now in use or under consideration:

Source of power.	Foot-pounds per pound of medium.
Good storage battery.....	15,000
Liquid air, from 2,000 lbs. to atmosphere	139,100
Coal, 14,600 B. T. U., used in steam plant of 12½ per cent. efficiency	1,408,000
Kerosene oil, 20,700 B. T. U., internal combustion motor plant of 35 per cent. efficiency.....	5,593,000

That is to say, it requires 50 pounds of liquid air or 400 pounds of storage battery to deliver the power obtainable from one pound of kerosene oil, costing about 1 cent. As a reservoir of power, one gallon of kerosene oil has more capacity than one ton of storage battery. The average export value of refined kerosene oil was, in 1888, 7.9 cents per gallon, and in 1898 5.2 cents, having fallen from 24.9 cents in 1872 to 5.2 cents in 1898. New sources of kerosene supply are constantly being discovered and worked, and it is not at all probable that the price of kerosene oil will increase in the near future.

Impressed by the great inherent advantages of kerosene oil as a fuel for heat motors, Mr. Secor set before himself the task of finding an engine which should burn kerosene perfectly and be of simple construction, conveniently managed, and, most important of all, perfectly reliable in action, and the result of his labors, which were of some years' duration, is shown in the extremely simple motor here illustrated, which runs at a high speed, feeds the liquid oil directly to the motor by gravity, without the use of any sort of "carburetor" or pump, governs well, and burns the fuel perfectly. It is, of course, quite impossible in the space here available, to follow Mr. Secor in his experiments, highly interesting as they were. His final conclusion was that if the cylinder charge could be made of uniform constitution, a certain proportion of oil and of air, perfectly mixed, then certain and perfect combustion would follow ignition, irrespective of the degree of charge compression. If perfect combustion of the charge takes place, there is no smell to the exhaust. If the combustion is imperfect, then the internal combustion motor exhaust becomes highly offensive.

The Secor motor, while designed expressly for the use of liquid kerosene oil as a fuel, is also well adapted to use a gaseous form of combustible. The action of the Secor motor is very simple, and will be readily understood from the diagram given in Fig. 1.

From the fuel tank *A*, having the emptying cock *U*, the oil descends through a curved pipe *B* and the valve *C*, which is governed by the float *B* to the constant-level tank *V*. The object so far is to obtain a constant gravity head for the flow of the fuel, which next descends through the bent pipe *E E* to the fuel admission valve *F*, whence it flows downward through the brass-cased glass sight-tube *H* into the air-admission bend *I*. The air admission to the cylinder is controlled first by a butterfly valve, not shown, but placed in the vertical air-admission pipe, through which air is sucked downward by the action of the engine piston. This butterfly valve may be used to throttle the air admission wholly, but seems to have no very well defined function, and may not be retained permanently. Next below the butterfly valve is a bored seat, in which is placed a segmental rocking valve *L*, which is under control of the governor, and is the effective member of the air-admission controlling mechanism. The valve *F* is controlled by the rod *K*, pivoted to a lever on the horizontal actuating arm *M* of the

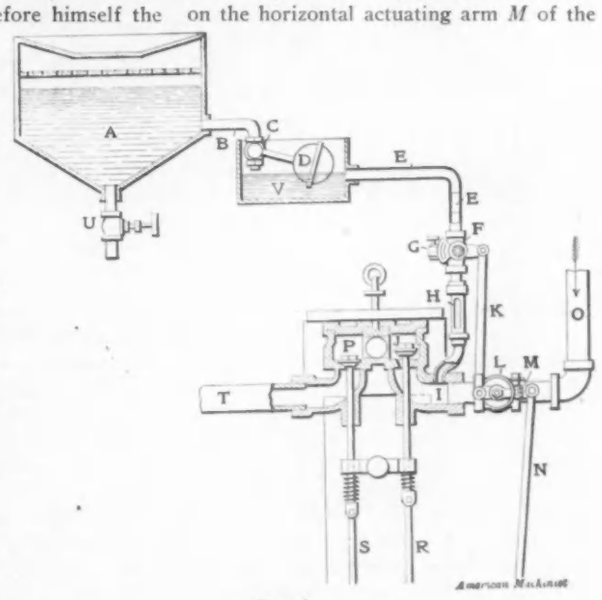


Fig. 1

DIAGRAM SHOWING THE ACTION OF THE SECOR MOTOR.

valve *L*. The governor rod *N* is pivoted to the right-hand end of *M*. This makes a single governor rod control both the oil admission and the air admission. To provide an independent adjustment of the volume of either the air or fuel admitted, a micrometer adjustment is provided at *G* for the oil valve *F*, and at *M* for the air valve, so that precisely such relative volumes of air and oil can be delivered together as are required to form a perfectly combustible mixture. The action of the governor is thus made to deliver the same proportionate combination for every charge, the regulation being effected by increasing or decreasing the volume of this mixture for a single cylinder charge. Throttling the total volume of the charge very rapidly reduces the compression pressure, and hence the initial cylinder pressure produced by the firing of the charge, although every charge, no matter what its bulk may be, is perfectly burned. Under these circumstances the governor action is so prompt that with the 6x9-inch Secor motor the belt may be thrown as quickly as possible from the tight pulley to the loose pulley without visibly affecting the engine speed. Also, owing to the perfect chemical constitution of the charge, due to placing both the fuel and the air admission under positive control, the charge is ignited and burned when the engine is running unloaded, and hence has only a very low charge compression, as certainly as when it is working under a full load, and has a high charge compression. The Secor motor is believed to be the first to place both the fuel admission and the air admission under control of the governor.

The half-tone reproduction of a photograph, Fig. 2, and the line engraving reproduction of the construction drawing of the same engine, Fig. 3, in connection with description given in connection with the diagram, Fig. 1, will give a full understanding of the appearance and construction of this motor. Very expensive forms have been adopted throughout, and much hand fitting is used. The general marine form which has been adopted is, although not cheaply produced, agreeable to the eye of those familiar with yacht and man-of-war steam engines.

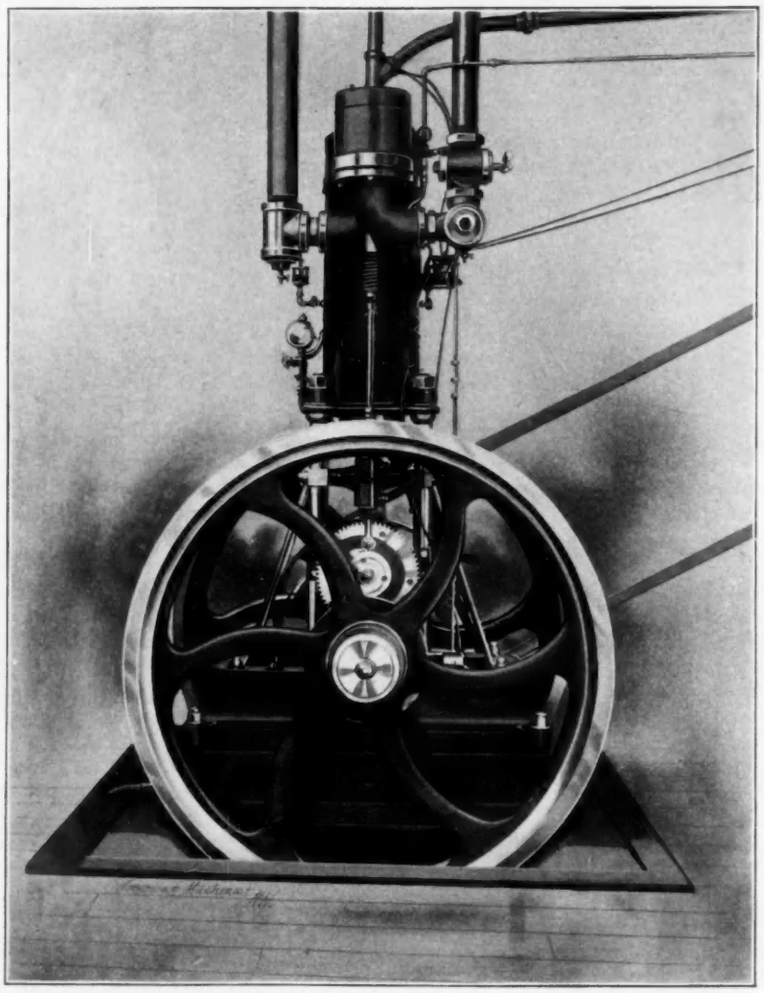


FIG. 2. THE SECOR ENGINE.

Referring to Fig. 1, *J* is the admission valve, operated through the rod *R*, from a cam of the usual type employed in explosion motors working on the Otto cycle. The rod *S* is similarly operated, and drives the exhaust valve *P*, which opens communication between the cylinder and the exhaust pipe *T*, leading into the open air.

The ignition is electric. The current from six cells of battery is led through a Rhumkorff coil to a jump-spark igniter, screwed into the top cover of the compression chamber. Each battery cell requires renewing once in six months. The practice is to connect one fresh cell each month. The Rhumkorff coils do not require renewal. There are no moving parts of the ignition device inside of the cylinder.

I have given the Secor motor a careful examination while at work, driving the shop, and running at about 350 turns a minute. The load varies greatly, but the speed seems very regular, and the exhaust sounds precisely the same as that of a well-governed steam engine, strong or faint according to the load, regular in occurrence, often without any perceptible odor whatever, and at no time being offensive. There is a distinct odor of burning kerosene in the engine room, but not enough to be objectionable. The engine runs as smoothly and quietly as a good steam engine, except, of course, the slight click made by each contact of the valve lifters and the valve stems. The time of delivering the igniting spark can be regulated closely, and may be made slow when starting, so as to avoid the possibility of premature explosion when turned slowly by hand.

When in operation the admission bend, leading to the admission valve, is so cool that the hand can be held on it without inconvenience. The cold fuel runs into the top of this bend, as shown in Fig. 1. By the glass sight-tube *H*, Fig. 1, the flow of the fuel downward is seen to pause each time the admission valve closes, and to hasten when the fuel valve opens. The oil does not meet any heated surface before it mingles with the air, and is probably atomized by the rush of incoming air, and so mingles with the air in a finely divided form, and is carried with it into the hot cylinder.

The Secor motor is water-jacketed, compression chamber and cylinder both, and the engine is remarkably cool when in operation. It is asserted that this motor, in small sizes, can deliver power at a fuel cost of ½ cent per horse-power per hour.

HUGH DOLNAR.

At the recent session of the Industrial Commission held in Washington, evidence was produced which showed that whereas before the use of pipe lines the cost for removing a barrel of oil from the oil regions to New York had been $5.50, the present cost was but 50 cents.

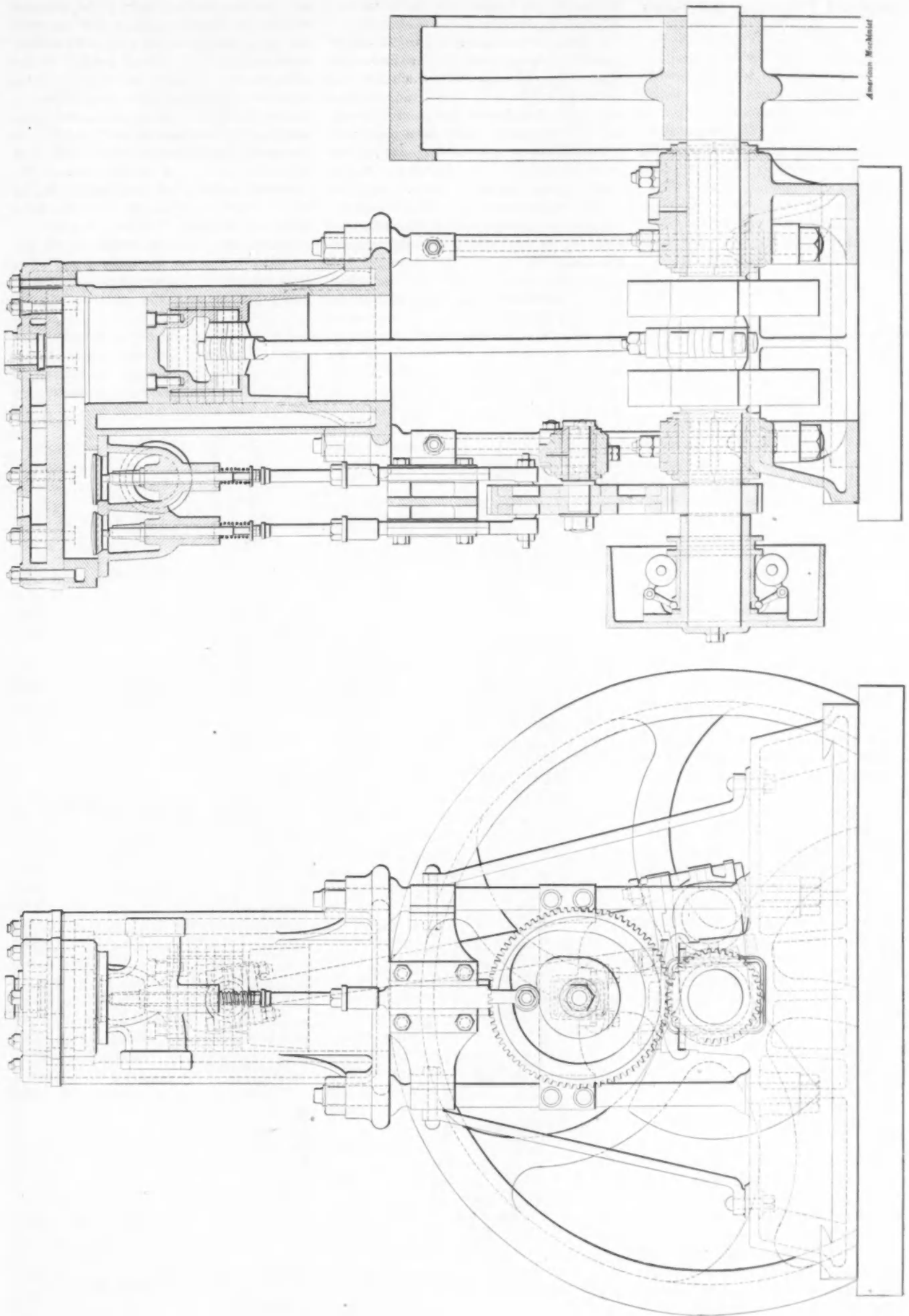


Fig. 3

SIDE ELEVATION AND SECTION OF SECOR ENGINE.

A Compound Punching and Forming Die.

BY W. E. WILLIS.

The illustrations herewith show a novel arrangement of both press and the punch parts attached. Of the press, it may be said that it not being of the inclined variety, nor even having an open back, and it being desirable to remove the finished pieces by gravity, the plan of tilting the entire press sideways was adopted with perfect success in everything, except appearance, which was decidedly odd. New legs, giving a side inclination of 30 degrees to the press, were provided in place of the usual supports. The center of gravity of the upper portion of the press being low, it was found to stand safely upon the new legs, and although the shorter one had on it by far the greater portion of the weight, no vibration or shakiness could be noticed while in action.

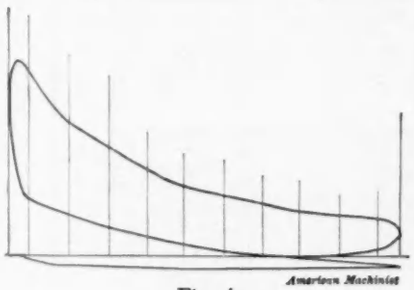


Fig. 4

INDICATOR CARD FROM SECOR ENGINE.

The special work for this press was the making of a small sheave pulley side, of mild bright sheet steel, about 2 inches in diameter and .04 inch thick. These sheaves were produced in large quantities, about 40,000 sides per day being called for. They had previously been made by first blanking the side, then piercing the hole and finally pressing into the desired shape in forming dies, the operations occupying three presses, each attended by an operator, as no automatic feeds had been employed on the work. After coming from the die the blanks were tumbled with sawdust as usual to remove any possible burr and the sharp edges, as well as to give a final semi-polish or brightening, and remove all trace of oil, which was plentifully used in the combined operation.

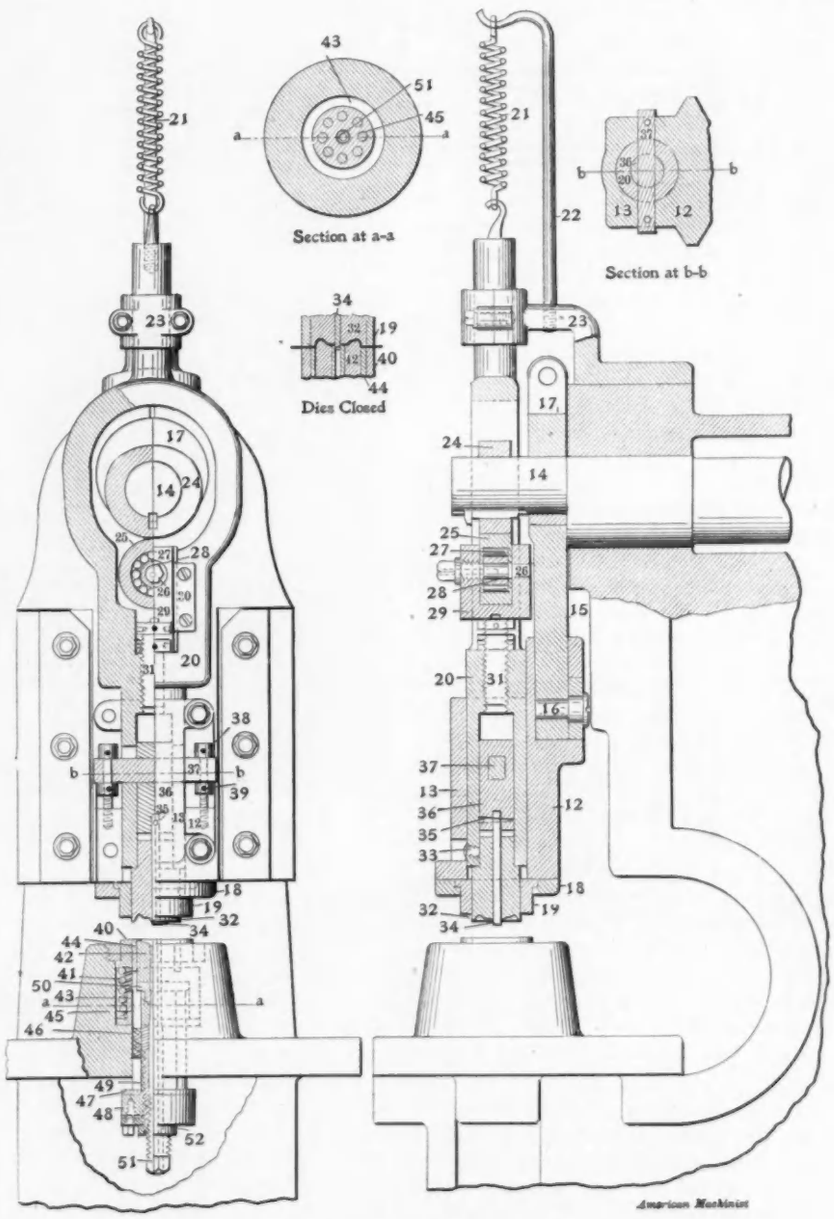
The design shown, while it was considered somewhat expensive in first cost, soon proved to be highly economical. Duplicate parts were made of those pieces which were likely to be broken or to wear out quickly, so that the press might run as uninterruptedly as possible, stopping only to make changes instead of repairs.

The alteration of the press, besides the inclined legs, consisted of a new special ram or slide, a new eccentric to move it, a special cam and cam yoke, operating through the slide, with a guide bracket on the top of the press, and a suitable heavy plate combining the functions of bolster, die block and support for the automatic roller feed, which was also added to it.

A detailed description of the drawing is given for those who may be interested. Fig. 12 represents the slide, which is guided vertically in the press frame and carries a housing 13, made in two parts for convenience of access, which form together a cylindrical bearing for the forming plunger. The slide 12 is connected with the crank 14 by a pitman or connecting rod 15, one end of the pitman being secured to the slide by a bolt 16, while the other end encircles the eccentric 17, the eccentric being adjustably clamped by the upper end of the pitman, so that any desired adjustment relative to the crank may be had. To the lower end of the slide 12, by means of the ring 18, is secured the pressure plate 19. This plate also serves as a blanking die.

Within the housing is guided the slide 20, which is held normally in an elevated position by the spring 21, which connects the upper portion of the slide with a standard arising from a fixed portion of the press frame, a portion of which 23 forms a guide for the upper end of the slide. A cam 24 is keyed to the crank 14 and operates the slide 20 against the pressure of the spring by bearing on a hardened steel wheel 25 carried on the stud 26. Antifrictional rollers 27 are provided, traveling upon a hardened steel bushing 28, fitted snugly on the stud. In order to obtain adjustment, this stud is carried in a yoke 29 which is movable vertically in the slideway 30; an adjusting screw 31 is provided for varying the elevation of the yoke.

The upper forming die 32 is fastened to the lower end of the slide 20 by a setscrew 33, passing through an opening in the front of the housing. A piercer or



A PUNCHING AND FORMING DIE.

punch 34 is provided, for punching the hole in the center of the blank, which passes through a central opening in the former 32 and has its upper end secured by a pin 35 to the adjustable plunger 36 carried in a recess in the slide 12. An adjusting bar 37 passes through the plunger 36 and has its ends secured adjustably to the housing 13 by means of the screws 38 and lock-nuts 39 in such manner that the punch 34 may be adjusted vertically with relation to the slide 12.

To hold the strip during the forming operation, a lower pressure ring 40 is provided in line with the upper ring 19, which is supported upon a strong steel spring 41, serving to hold the ring 40 firmly up against the ring 19 when the latter begins to descend, thereby clamping the stock under a powerful tension. The lower former 42 rests solidly upon the ring 43, which is firmly supported by the cast iron die-block, resting in turn on the bed of the press.

In order to blank out or sever the pulley section from the strip after it has been formed, a lower blanking ring or punch, 44, is provided, encircling the lower frame, said ring being supported on a series of laterally adjustable steel pins. Two of these, one of which is shown at 45, the other being diametrically opposite, are kept in contact with the punch by a coiled spring 46, which causes the ring to act as a stripper, or means for forcing the blanked section out of the bottom former. The other pins rest on the steel washer 47, which is supported by the nut 48, the nut being split so that it can be securely clamped in any position.

The pins are of such length that there is a space between the bottom of the punch and the top of the pins, this space representing the amount of compression of the springs 46. As the blanking ring 44 is worn or ground away it may be adjusted vertically by the nut 48 on the screw 49. This pressure plate 19 also serves as a blanking die, the material being sheared between the edge of the plate or ring 19 and the edge of the plate or ring 44, as indicated in the sectional view of the punches and dies. It is to be noted that the severing of the blank from the strip of sheet metal does not take place until the blank has been fully formed.

On acount of the reciprocating motion of the punch 44 there is a tendency of the former 42 to work up out of the holder, which is overcome by having a sleeve 50 fastened to the bottom of the former 42 and threaded into the sleeve 43. In order that the hole in the center may be punched by the piercer or punch 34 at the same time the blank is cut, a round die is provided, which is supported and adjusted by the hollow screw rod 51; this adjustable rod is threaded into the sleeve 43, and held in proper position by the lock-nut 52.

The operation is briefly described as follows: The strip of metal is placed or fed between the formers, and the revolving of the crank forces the slides 12 and 20 down in unison. As soon as the rings or plates 19 and 40 come in contact with the work, the lower end is depressed and the formers 32 and 42 begin to draw the metal into shape, the surrounding stock being in the mean time securely held by the pressure plates 19 and 40. When the former 32 has reached the limit of its downward stroke, and the blank is fully formed, the relative arrangement of the cams operating the slides is such that the slide 12, and with it the pressure plate 40 and punch 34, continues its downward movement. By this time, however, the springs 46 have been compressed until the ring 40 rests solidly on the pins, and the further downward movement of the pressure plate 19, acting against the stationary edge of ring 40, shears off the metal, while at the same time the punch 34 cuts out the center hole. In the continued movement of the crank shaft, as soon as the slide, with the ring 19, recedes, the pressure ring 40 is forced upward by the springs 46 and 41 out of the former 42, when the cam 24 has revolved so that the former 32 will start downward, carrying with it the formed blank and strip, which, being moved along at the same time, should carry the formed blank out from under the tools, delivering it free from them and leaving the strip in readiness for the next operation.

Tariff on Machine Tools.

It will be remembered that some time ago we quoted from a circular letter addressed by Mr. John A. Johnson, president of the Gisholt Machine Company, to a large number of American machinery builders, asking them to state their opinions as to the necessity for maintaining a high protective tariff on machinery which we admittedly manufacture at lower cost than it can be made for elsewhere, and which we are exporting in large quantities. Mr. Johnson now issues another circular letter, which is as follows. We do not agree with all he says in this letter, but present it entire:

Gentlemen—Having received numerous replies in response to our circular letter of March 22d, relating to reduction of tariff duties on machinery, it occurs to us that those who received the circular may desire to know something of the nature of the replies.

Of those received about 20 per cent. say that the writers have not the time to consider the question, or are neutral; about 20 per cent. are opposed to reduction or change, and about 60 per cent. are in favor of material reduction in the duties on machinery, or of placing it on the free list. If those who are neutral or undecided are divided in the same proportion as those who declare themselves, those who favor tariff reduction or free trade in machinery embrace 75 per cent. of all who have sent replies. Considering the fact that nearly all manufacturers either are or have been protectionists, it shows a decided change in regard to the tariff.

It should be remarked that among those opposed to change, are some of the leading concerns of the country, as well as among those who favor it. However, among those who favor a change, are many who have themselves spent considerable time abroad in the interest of our business.

We are of course not authorized to publish the names of the writers of the letters, but we do not believe there is any objection to the printing of the letters in a trade paper (several have applied for them), if no indication is given as to the authorship.

It should be noted that our circular letter was sent only to machinery manufacturers, and to but a limited number of them, and the replies are from machinery manufacturers only.

Among the opponents of tariff reduction are two who think retaliatory tariffs would be beneficial to this country. One thinks that our export of agricultural machinery has worked serious injury to us; the other that foreigners getting our tools will copy them, thus improving their methods, and in time they will invade our own home markets, if not shut out by our tariffs.

These parties do not seem to realize that it is impossible for us to prevent foreigners getting our machinery to copy. A very considerable number of foreigners are constantly traveling in this country, to see what they can learn and to find machines that they can profitably copy. Such men are usually freely admitted to our workshops, and they certainly profit by their observations. Not unfrequently do they employ some of our best engineers and mechanics.

It would hardly seem that American prosperity will find a safe resting place on the policy of exclusion and seclusion. Such has never been the policy of the intelligent protectionist. His theory has been that when our industries are once firmly established, protection becomes superfluous, other things being equal. The difference in labor cost might still make protection necessary in a measure.

But if the difference in the price of labor is made up by other advantages, still protection may be superfluous. Our labor is certainly more intelligent. It is better fed, better clothed, better housed. It therefore should be, and is, more efficient.

And we have other advantages which our foreign competitors lack. We have cheaper food. We have greater natural resources. We have cheaper railroad transportation. We are free from exacting military service. Our taxes are much lighter. Our people need learn but one language; in Europe many must learn several languages. We have a uniform money unit throughout the continent. Europe has a good many, which enables

bankers and brokers to levy heavy tolls upon business. These trade restrictions between the numerous nationalities are embarrassing and burdensome. Our free intercourse among the States has an advantage we hardly appreciate. Here a part of the same machine is frequently built in Connecticut, and another part in Wisconsin. This free intercourse enables us to specialize, and greatly reduce the cost of production. The difference in languages, railroad systems, tariffs, money systems, etc., greatly hampers specializing in Europe, and always will.

America is bound to be the great manufacturing country of the world. We have the conditions. Protective tariffs are the swaddling clothes of the youngster. We are rapidly outgrowing them. They are still necessary in some branches of our industries. In the higher grades of textiles, for instance, we are yet far behind some of our competitors. And these higher grades are also among the luxuries, and can well bear heavy duties, even if for no other purpose than revenue.

England employed the policy of protection for a very long period, to place her industries on a firm basis, and then abolished it. This policy has made the little island the most powerful, the wealthiest and, at least until recent years, the most progressive nation in the Old World. May we not profit by her example? If that policy has made Britain what she is, what may not the same policy work out for this country?

There is one branch of manufacture that yet sadly needs encouragement from our government—that of ocean shipping. In regard to this industry our policy has been most unwise and niggardly. Liberal aid should be granted to this most important industry—important not only in itself, but of vast importance to so many of our other lines of production.

The tariff should be modified by the friends of the protective system, just as it was in England, not by the enemy of all protection. It will then not shake public confidence, or cause even business depression. Every business interest fears violent and radical changes, even when the tendencies are right. A wise policy henceforth will rapidly and unerringly open the markets of the world to American genius, skill and vigor. We cannot hope to crush all competition, nor is it advisable that we should do so. But we can fully hold our own. We can do more. We not only gain in the foreign markets of our European competitors, but we invade the busiest home markets of our ablest and most progressive competitors, and in these very markets our trade shows the greatest gain.

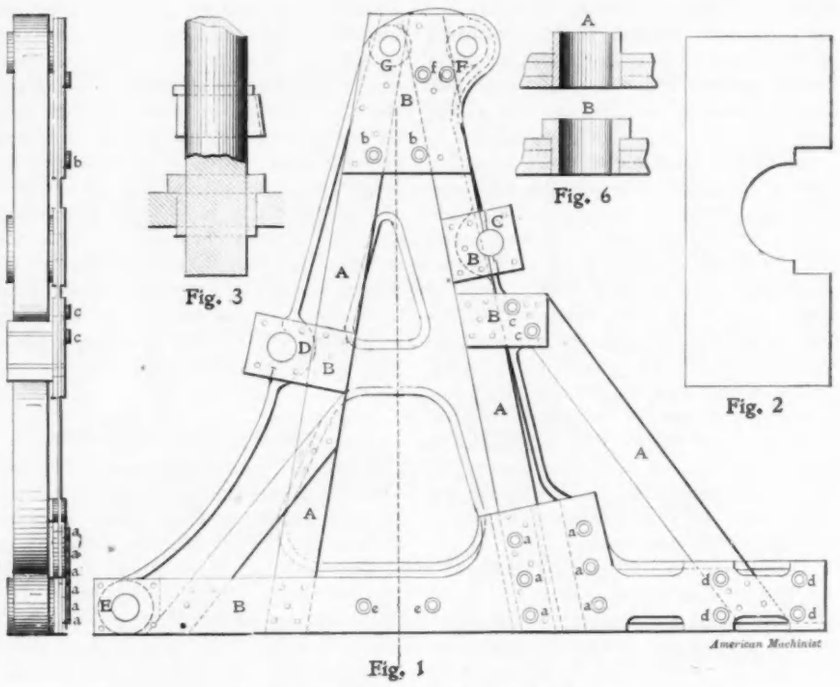
It is to be hoped that a fair and intelligent discussion of this most important subject will lead to such action on the part of Congress as will promote the best interests of the country.

Machining Crane Cheeks.

BY JOSEPH HORNER.

The machining of crane cheeks, or side frames, commences with the planing of the various facings on back and front, on which a rough cut and a finishing cut are taken. In the case of facings against which work is bolted, a single rough cut often suffices. Then, if lining or laying out is done at all, it is done at this stage.

When the bearings of frames are lined out previous to boring, they are bored in one of two ways—either in pairs, under the drilling machine, with a cutter set in a bar in the drill spindle; or, after the cross girders and stretchers which maintain the frames at their proper distance apart have been bolted between them, the whole rigid skeleton structure being set between the uprights of a horizontal boring machine, having a low bedplate and tall standards. The latter method is more troublesome, and its results are no more accurate than the former when done by a careful man.



ENGLISH PRACTICE IN CRANE BUILDING.

In bearings which are fitted with caps, the seatings for the caps have to be slotted, and this operation is performed previous to boring. Most large frames are fitted in this way. But the caps and bearings may be fitted with complete brasses, or a half brass may be used in the bearing only, the other half of the bore being in the iron cap. Or no brasses may be used, the shafts running in iron bores only.

This slotting, boring and fitting of brasses means several shiftings, resettings and readjustments, which cannot be avoided; neither can slight inaccuracies be absolutely prevented when scribed lines only are worked to. But when a templet is used, this is clamped down upon a pair of frames on the table of the drilling machine, and the bearings are reamed out by the guidance of the templet alone.

The templet used may be of solid sheet iron or steel, if it is of small dimensions; or it will be framed up when of moderately large or of maximum dimensions. In the first case cast iron blocks are riveted on at the parts which correspond with the bored holes, in order to give guidance for the reamer. Or steel bushes are inserted at those parts. In the framed templets the same device of cast iron blocks is adopted, unless, as is often the case, the thickness of the bar used in the framing is sufficient, as when a double thickness of bar is formed by crossing in those localities where the holes come.

Fig. 1 illustrates a drilling templet used for the large side cheeks of vertical cranes. It is made of sheet steel ranging from ⅛ to 3-16 inch in thickness, framed together in the manner shown. Three single thicknesses *A A A*, running vertically, are flanked by double thicknesses *B B B B B*, riveted together. The templet is shown in position on a side frame casting.

The principal holes are those for the engine shaft, *C*, and the hoisting drum or barrel shaft, *D*. The two are connected in the finished crane by a pinion on the engine shaft, which gears with a large wheel on the barrel shaft. In large cranes, say over 8 tons, there are intermediate gears in addition and an extra shaft. These gears are nearly always cast, this practice being departed from only in very exceptional cases. As the distance between *C* and *D* will vary from about 2 feet to 3 feet in cranes of different powers, it often

happens that there is trouble when the templet system is adopted in making the centers uniform, because of the different degrees of shrinkage which occur both in side frames and in wheels. The barrel wheel is frequently machine molded; often, too, it is made in steel, and in each case dimensions are found to vary. Yet it is necessary to maintain constant centers between *C* and *D* if frames are to be interchangeable, or if damaged frames are to be replaced without the necessity of having the damaged ones returned to the shop. It is well, therefore, to insist on exact centers being maintained, and then

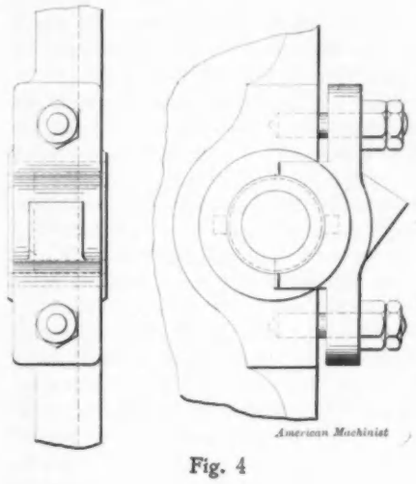


Fig. 4

in time it will be found that gears will be turned out practically accurate, for more care will be exercised in setting the radius of machine molded wheels and in grading metal for gears. By the use of cut gears these difficulties would be got over at once, but we are not yet within measurable range of cut gears for common cranes, some of the high speeded ones on electrical travelers being excepted.

The bearings *C* and *D*, Fig. 1, are divided and capped. This involves, as previously mentioned, fitting of the caps before the bearings are bored. To get the positions of the caps the templet is laid upon the casting and into an average position, by bearings and bosses rather than by outer edges, which are of relatively less importance. But if castings are made carefully, and metal of uniform grade put into them, there will not be much want of coincidence between either.

The templet being adjusted, the half circles for *C* and *D* are scribed on the faces of the bearings, and the templet removed. A small templet, Fig. 2, is then laid on and set by these half circles, and from it the edges to which the cap has to be fitted are scribed for *C* and *D*. A pair of frames, then clamped together, is put under the slotting machine, and the cap seatings are tooled. Thence the frames go to a radial drilling machine having a pit, and are bolted to the vertical face of the table, to have the stud holes for the caps drilled and tapped. The caps are then fitted and bolted in place. The frames are laid horizontally on the table of a radial drill, the templet readjusted, and the bearings bored, and the rest of the holes drilled through both frames at once. The removal and replacement of the templet cannot be avoided. It seems a more formidable task than it is in fact. A couple of men can move it easily. It is retained in position on the frames with screw clamps.

There is usually a considerable quantity of material left to bore, because of differences in setting cores and in shrinkage. From ⅜ to ½ inch diameter is left in the main bearings. This necessitates two cuts through.

The bearings *C* and *D* range from 2½ to 3½-inch bore in different cranes. In these the roughing cut is taken with a rather broad cutter held in a bar, the lower end of which is steadied in a thoroughfare hole in the table, bushed to suit bars of different sizes, Fig. 3. This is followed by a rose reamer finishing the hole. "Broaching" is the term often used in England, a term which has a different meaning in America. The rose reamer is used in preference to the fluted type, because it will receive no injury from the hardened steel bushes in the templet, which might occur to the fluted reamer.

When brasses are fitted in bearing and cap alike, these are bored, turned and faced in a lathe, ready for insertion into their seatings, so that nothing is done to them under the drilling machine or after they are in place. Brasses are mostly fitted with circular seatings, for cheapness, and they are retained in place either with a stud, Fig. 4, in each half, entering into drilled holes, or they have outside flanges,

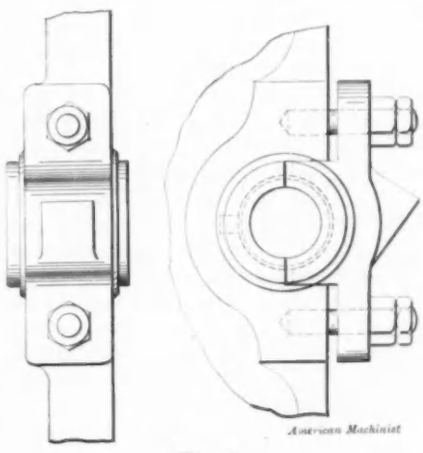


Fig. 5

Fig. 5, the inner faces of which make a close fit with the facings on the frame. The older method of fitting brasses by filing flats or angles is much less common in crane work than it was a few years ago.

When there is a half brass only in the bearing, the cap not being similarly lined, the better plan is to bore the half seating in the bearing first, insert the turned brass —not yet bored—bolt the cap in place, and bore half brass and cap together. There is no difficulty in boring a half seating true, because the holes in the templet coerce the reamer and prevent it from springing back from its work. The reamers which are used exactly fit the holes in the templets, so that vibration or eccentricity of the cutter is impossible.

The hole *E*, Fig. 1, which receives the front roll box, is treated similarly to *C* and *D*, excepting that it is bored in the solid. The holes *F* and *G* for tie rod distance piece and derricking barrel shaft, respectively, being smaller, are roughed out with a twist drill and finished with rose reamers. The various small bolt holes are drilled at once through solid metal—that is, no preliminary coring is done. These holes are: *a*, for cylinder feet; *b*, *c*, *d*, *e*, for cross stretchers; *f*, for a small derrick-brake bracket. These are not reamed on the machine, but subsequently, after the cross girders and cylinders are clamped in place, when the holes are reamed by hand. The work is too heavy to permit of absolute coincidence from the machine, except by the outlay of larger sums than would be warranted in the common crane industry. These small holes sometimes pass through bosses, and these, when not situated at the same general level as the shallow facings, are not planed, but arbored after the drilling of the holes and at the same setting of the casting.

The steel bushes, Fig. 6, through which the small holes are drilled, are turned, drilled and driven into holes in the templet. They are parallel in Fig. 1 and at *A*, Fig. 6, but they may be flanged, *B*. Properly, they should be hardened and lapped out. But if unhardened they last a long while, and can be readily renewed.

Letters from Practical Men

About Drawing Curves.

Editor American Machinist:

Pearson, the screw machine man, was in the office yesterday. He is rather proud of the curves on the legs of his late machines, so I asked him how he lays them out. "True ellipses, laid out from the foci by means of a fine copper wire." That brought up the subject of my recent letter objecting to the use of the irregular curve in the drawing room, and Prof. Sweet's emphatic objection to my contention. That reminds me of an experience of mine in the early eighties.

Professor S. P. Langley, of the Smithsonian Institute, who, in addition to being a great scientist, is a very capable mechanic, was at that time director of the Allegheny Observatory, and had been making an extended study of the relative wave lengths in various parts of the spectrum, using in his observations the "bolometer,"

an instrument which converted heat energy into electrical energy and enabled him to get a record by means of a galvanometer.

The results of the observations were plotted on cross-section paper, the ordinates representing wave length and the abscissæ representing position in the spectrum. About a dozen of the most prominent mathematicians in the world constructed formulas supposed to represent the relation of ordinate to abscissa. Here is where I got into the matter. I took the formulas and plotted points which I had to join up by smooth curves, and finally draw an average curve. Of course, none of these curves was circular, and our final curve was a hyperbola.

I told Professor Langley that I would draw those curves in by patching together arcs of circles. He objected very seriously. He felt about as Professor Sweet does, and got very indignant at my audacity in holding out for my way, telling me that as the curves were of constantly varying radius it was quite impossible to draw them as I proposed. I did the work my way, anyhow, and the result was eminently satisfactory, and elicited his warm praise.

First, to pencil in my curve, I used a thin hard rubber spline which I bent around pins stuck into the board. This gave a smooth curve, not circular. Then I took a set of cardboard "railroad curves," varying in radius from 1½ to 60 inches, and hunted out those that fitted various parts of my pencilled curve. These were then used to guide my pen in inking in, and the finished curve did not show the slightest trace of joinings, nor did it convey to the most practiced eyes any intimation of its being composed of circular arcs.

Now, I don't think it a fair deal for the "artistic pattern maker" to be obliged to draw freehand curves and spokeshave templates, when the draftsman can furnish him with exact radii which will fit together and produce the "artistic curves" Professor Sweet praises, and if the Professor will try it, he will do as did the other great man, and come over to my side of the fence; and so will friend Pearson, whose way of drawing ellipses, while theoretically correct, is practically productive of unlimited profanity.

L. O. Danse.

Paterson, N. J.

Waste and Scrap.

Editor American Machinist:

It is rather curious what a change a few years has brought about in the status of the waste materials in the various industries. The change is by no means complete, but is continually in progress. Each industry tends to increased economy in operation, to improved and enlarged product for the material handled and the labor employed. As a general proposition it may be said that there is waste of material wherever material is handled in any of our conversion processes for increasing values by the adaptation to some of our numerous wants. The general tendency of improved production is, first of all, toward the reduction of the amount of waste material resulting, and then to the utilization in other ways, and to the enhancing of the values of the waste that is still unavoidable. In the transformations which have occurred in some of our most prominent industries the wastes have been dignified as by-products, and in some cases the by-products have become the most important and valuable part of the output.

The tendency, however, has not been altogether in the one direction. When I was twelve years old my most intimate schoolfellow and constant companion was the son of a butcher in a village far away from any large city, and he and I used to hang around the slaughter house, and I became familiar with all the operations connected with the killing and dressing of cattle, sheep and pigs. The most striking thing to be thought of as I look back at it is the enormous waste of material that occurred. In the wholesale slaughter house of to-day there is absolutely no waste or worthless material, and it is not hard to believe, as we are assured, that the vast wealth of the Armours and the Swifts has largely come from the once discarded and despised constituents of the slaughtered animals.

In connection with the installation of some special machinery a few years ago, I had a week or so of leisure around one of the finest "packing houses," as they call them now, and I can imagine no contrast greater than that between the village slaughter house and the magnificent establishment in Kansas City.

Another kind of waste material that I was familiar with in those early days has very decidedly gone the other way. I used to do quite a business in collecting and selling linen and cotton rags. They used to pay me, as I remember it, four or five cents a pound, and the money so realized was an important item of my juvenile revenue. Now wood pulp has knocked that all endwise, and I don't see any boys of the present generation in the rag business. We have cheap paper and cheap books, but in the libraries of A. D. 2000 where will be the books of 1900? They will be using something else instead of wood pulp for paper in those days.

Still different from either of those have been the vicissitudes of scrap iron. When I was promoted from the village school (and no better school exists to-day) to the little shop, there were then but two kinds of scrap iron, cast and wrought, and the wrought scrap was worth the most. We made lots of scrap in those days, if nothing else, and scrap iron was as sure of sale as any other product. In buying cast iron they used to kick about old gratebars, or any iron that had been badly burnt, but otherwise there was never any objection to anything that was offered. After a few years, however, when malleable iron began to be common, there began to be trouble. They wouldn't buy malleable iron, and if malleable iron got mixed in with the rest it damaged the whole. Cast iron, however, with this exception, has held its own bravely, until we are entitled to think that it in any form, pig or scrap, represents one of the most certain, if somewhat unstable, values in the world. With wrought iron scrap, however, we don't know very well "where we are at." Bessemer steel, machinery steel, tool steel, have crowded it almost out of the machine shop, and nobody knows very well what is the wrought scrap of the general machine shop, and I have no idea what it is worth.

But the thing most important and best to be said about scrap iron is that there is so much less of it than there used to be. I believe that this is true, not only comparatively, but absolutely. Notwithstanding the enormous increase in the production, and the vast extension of the use of iron, the scrap iron yard and the scrap iron dealer are by no means as plenty as they used to be. For any given amount of work turned out of the machine shop we certainly have fewer chips to show than we would have had, say, about the middle of the century. Our patterns and our castings are more carefully designed and more accurately made, so that less cutting and fitting are involved in the shop. But especially in the various forms of wrought iron and steel is the saving most noticeable. We have now so many special rolled or forged shapes, where once we had only standard bar iron, that the difference in the work involved and in the chips made is enormous. When we see the giant skeletons of our office buildings going up it is easy to believe that in avoidance of waste the standard of the modern beef packing house has been nearly reached. Why, the shop work on the skyscraper frame or on the railroad bridge seems to be very largely the cutting off of standard shapes to length and the drilling of holes, and, as the material left is perfectly homogeneous, it can go immediately to the furnace again, and where is the scrap at all?

The iron once in use was, more or less truly, a circulating medium, and the scrap iron dealer merely helped to keep the stream flowing. The iron was then used for things that broke or wore out or got out of fashion, and then became raw material and had to be worked over again. We have proportionately much less of that sort of thing now. Take two or three of the special lines of manufacture which in these days call for lots of iron, and it is a long road from them back to the scrap pile. Take the Park Row Building in New York, with, as they say, as much steel in it as in 100 miles of railroad; take the other buildings in all the cities; take the Atbara bridge, and all the other

bridges; take the war ships and the merchant ships of the world—and out of all these what does the scrap iron dealer get? There is no prospect that anywhere in the future he will ever have any better chance. His day is going. TECUMSEH SWIFT.

Turning Piston Rings.

Editor American Machinist:

The turning and facing up of piston rings is a job that needs care, or the expense account of the rings will be as bad looking as the rings themselves. If a job is turned out of the lathe bad, it is a bad job all the way through. It has to be doctored here and there and perhaps finds its place in the scrap pile. We cannot, either, say that it is always the poor mechanic that turns out the poor job, for mishaps will occur sometimes with the best of men; but then it is usually caused by matters beyond his control. His machine may need repairs, a matter that he has often reported, but nothing has come out of it, and this one bad job may cost more than to have repaired the tool many times over. There are a great many companies that say it does not pay to use a machine that is either out of date or badly in need of repair, even though the repair might put the tool in shape to do that particular job just as well as a new one, and though, if the repairs had been kept up when required, the tool would have been good for many years. The danger in this direction is that when a concern adopts this line, a great many tools will be taken out and replaced when the difference in cost will not meet the difference in saving. If it costs $2 to turn out a piece of work on a machine that is worth $600, and it is replaced by one that costs $3,000 and the piece may then be produced for 3 per cent. less, the wear and tear of the new tool may more than offset the saving. There are cases where a large amount of money has been used in the purchase of machinery and plant and where the result has been very wide of what has been expected. Money put into tools that are producers, if the tools can be kept at work, is well spent; but when the dollars are put into brick and mortar care must be used, or the amount so invested will not show at the end of the year. There are other concerns who have made the mistake of thinking that because they had a great amount of floor space they could set machines as far apart as they chose. But when the time came for increase of plant they must go to the expense either of digging out old foundations and putting in new, so as to close up the tools, or of adding new buildings.

Now, in the matter of piston rings, we might say we will put in a new machine, specially designed, drawings and patterns made, and only one of them built, at great cost, that will take care of these rings all right. But the money might be used to a greater advantage in an increase of the number of regular tools and some special attachments devised for this job.

The piston ring that is used very extensively of late years is a single ring turned about 3-16 inch to the foot larger than the bore of the cylinder, sprung together after cutting and filed to fit the bore. To do this by hand is expensive, and there is

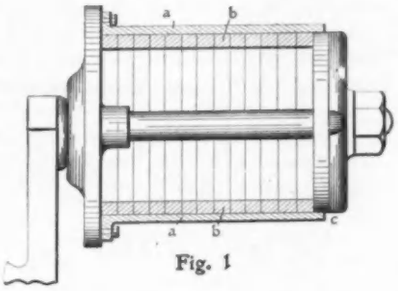


Fig. 1

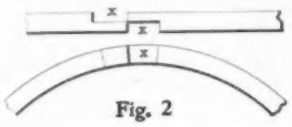


Fig. 2

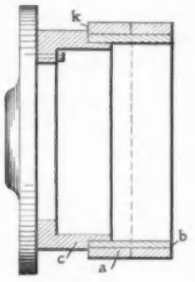


Fig. 3

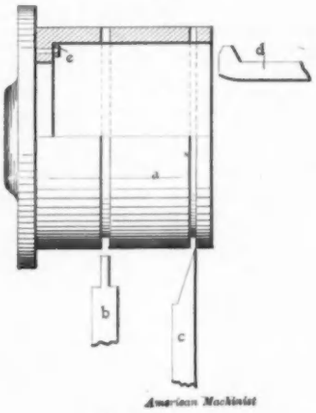


Fig. 4

TURNING PISTON RINGS.

danger of spoiling the ring by filing too much and having the ends stand open in the cylinder. To get over this hand filing I devised the arrangement shown in Fig. 1. A special face plate was finished up, with a good, strong bolt screwed into the center of it, with a plate *c* turned true on the outer end of the bolt and fitted into the ring or sleeve *a*. After cutting the rings, as shown at *x x x*, Fig. 2, we placed a number of them inside of this sleeve, springing them together, and after drawing the plate *c* hard against the rings we could remove the sleeve *a* and take a light cut over the lot at very slight cost. The bore of the sleeve should be just enough larger than the cylinder bore to allow this cut to be taken. The amount required to be cut out of the ring at *x x x* is about three times the amount that the ring is larger than the bore of the cylinder; or, to be exact, multiply the difference between the bore of the cylinder and the diameter of the ring by 3.1416.

In Fig. 4 is shown the method of preparing the rings for Fig. 1. In the first place we take the ring or sleeve from the foundry and face the edge where it is bolted against the face plate, so that the casting may be without spring. It is a bad practice to catch the casting in a chuck to finish the rings, as the chuck jaws will distort the sleeve casting, and when the rings are cut off they will be out of round. To have a still better job, after the rough cuts, inside and out, have been run over the sleeve *a* it should be loosened and allowed to take its natural shape, after which we tighten up the bolts *e* and proceed. We first cut down the groove with the square-nose tool *b* to within about 1-32 inch of going through. Then with a good sharp side tool *c* take a finish cut inside, and also with the opposite side tool finish the outside. Now we put in a boring tool *d*, and cut away the stock inside, and the ring will drop off.

Fig. 3 shows the method of finishing up the old-style three-ring packing, one inside and two out. After cutting them off from the sleeve, as at Fig. 4, we drive them together, and by using the short end of the sleeve c, Fig. 3, as a mandrel, we may take a cut over the ouside and face up the outer edge. In turning this mandrel care should be used in squaring the edge *k*, so that the rings may run true at this point and not require facing.

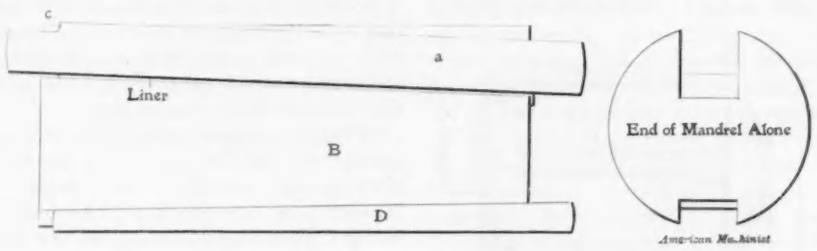
H. S. BROWN.

A Key-Seating Device.

Editor American Machinist:

The sketch shows a handy, cheap and quick way of cutting keyways in wheels where there is no slotter and no prospect of getting one. *B* is a plug or mandrel that fits the hole and is keyed fast by the key *D*. Opposite this key is another deep key-seat, with the same draft on the bottom as is required for the key-seat to be cut in the hole. The cutting is done by the drift *a*, which is made of square tool steel with a cutting lip *c*, near the further end of it. The keyway for this drift has to be deep enough at the beginning to let the drift just go through, or almost through, and then the cuts are made by slipping thin liners, one after another, under the drift. The end of the liner is bent down to keep it from

dragging through with the drift, and it is thoroughly greased. The drift is driven through by a sledge or heavy hammer, then another liner added and the operation repeated until the key-seat is deep enough. The result will be a key-seat as clean as if cut in a slotter that cost $1,000. I made my mandrels about 12 inches long, and



the drifts about 13 inches. Key-seats were cut from ½ inch up to 1¾ inches. The taper shown in the sketch is more than is needed, but it shows the operation better. The first of these I made thirty years ago.

J. A. S.

A Simple Friction Drive.

Editor American Machinist:

The sketch sent herewith shows a friction drive that I saw and had explained to me in one of our Eastern shops. In this case there were two shafts, end to end, one of which drove the other by this friction device, which may, of course, be used under other conditions, as in driving a loose pulley anywhere on a shaft, or using such a pulley to drive the shaft. A thick solid disk *A* is keyed to the driving shaft, and the cup piece *B* is keyed to the shaft to be driven. The inside of *B* and the outside of *A* come as near together as they can without binding. *A* is slotted all across for the four dogs *d*, and the slots are widened toward the outside, to give the dogs room to swing a little. Four holes are drilled and the springs and plungers are put in as shown. When the dogs are in the position shown they do not drive, and *B* could turn freely in the direction of the arrow. When, however, *A* turns in the direction of the arrow the dogs swing back and bind against the inside of *B* and drive it. The plate *C* is fastened to *A* by four screws at the holes *c c*, and they turn together. This plate prevents the dogs from working out, or dirt from getting in.

VICTOR MORRELL.

The Preparation of Metallic Indicator Paper.

Editor American Machinist:

Seeing your answer to question No. 80 in the September 21 issue of your paper, I would say that metallic indicator paper is coated with zinc oxide.

The paper should be sized with glue or paste, and the zinc oxide, in powder, should be sprinkled on before the size is dry. When dry the paper must be pressed or rolled smooth. I have found that running it through a photographic burnisher gives the best surface.

For a pencil, use a brass wire with end rounded and buffed smooth.

H. B. MAXWELL.

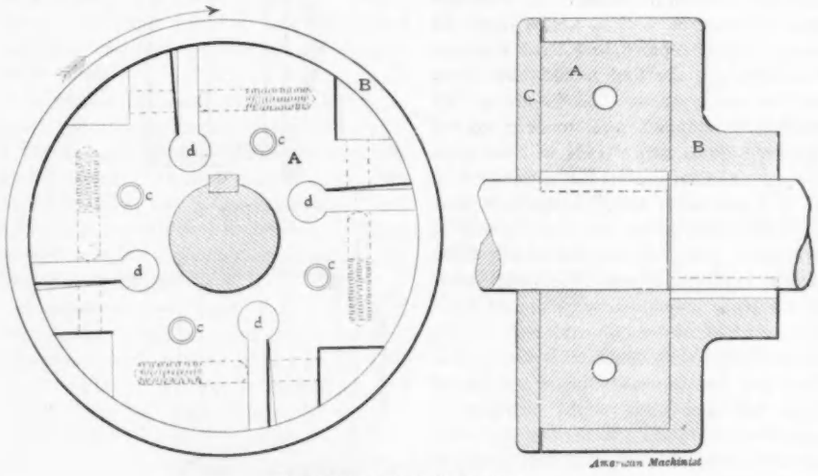
Rome, N. Y.

His Own Iron Mine.

Editor American Machinist:

A plow manufacturer needed 50 tons of a certain iron for mixing purposes, but found it impossible to obtain same promptly, even after the industrious application of all conceivable "old customer," "personal favor" devices. He must be an "Old Man," for he rigged up an apparatus in the shop yards, such as might be used for washing gold sand, dug up the walks and driveways, and refuse piles of grit and grindings which had accumulated during twenty-five years of business, and had washed out over 30 tons of iron when my informant saw him, and had raw material in sight for as much more.

C. M. SAMES.



A SIMPLE FRICTION DRIVE.

Locating Tools on the Shop Floor.

Editor American Machinist:

Sometimes very simple looking problems are very hard to solve, and when they have been solved we often wonder why we could not unravel them at first. Such was the case with the little problem given below. It was very simple, and yet it made the superintendent of the shops scratch his head more than once before he solved it.

A machine-shop building is 115 feet 3 inches long, and the following machines were to be placed in a line lengthwise the building: One 60x60-inch planer, extreme length 28 feet; one 36x36-inch planer, extreme length 17 feet 6 inches; one 6-foot boring machine, extreme length 12 feet; one horizontal boring machine, extreme length 20 feet 9 inches; one 4-inch slotter, extreme width 9 feet; one wheel press, extreme width 2 feet 6 inches; one No. 2 radial drill, extreme width 7 feet. The space between each wall and the first machine was to be 9 inches, and the space between any two consecutive machines was to be 18 inches, except the wheel press and slotter, which were each to have 4 feet space at their fronts, and the radial drill was to have 5 feet 6 inches on either side of it.

Should we add the space between the machines to the machines and consider the whole as space taken up by the machines, we would have a total length of 120 feet 3 inches required.

Now, the puzzling thing was to get these machines in the line with their proper distances, when the sum of their spaces was 120 feet 3 inches and the actual length of the building was only 115 feet 3 inches.

At first it would seem impossible to place them with their distances, and yet this was done, giving the slotter and wheel press each 1 foot 6 inches more than was required.

This was done by cutting out of cardboard the general shape of the foundation of each machine, and with these little cardboard machines a game of checkers was played, giving the arrangement in the following order: 60x60-inch planer, 36x36-inch planer, 6-foot boring machine, horizontal boring machine, slotter, radial drill and wheel press. It so happened that the slotter and wheel press faced in opposite directions, otherwise no possible arrangement could have been made. The faces of these two machines were placed 18 feet

apart, and the radial drill was placed midway between them.

It will be seen that all of the machines could have been interchanged except these three; but they must, in any arrangement, be placed together with the drill between the other two. JIB.

[The usefulness of cardboard models in locating machines on a shop floor is not so widely understood as it deserves to be. No one who has not tried it can realize its convenience, and no one who has tried it will ever think of using any other plan. Conflicts can be avoided and the available floor space utilized to the best advantage with a fraction of the labor required by any other plan, and a job which is about as tedious as can be imagined by any other method becomes a pastime by this. —Ed.]

Technical Publications.

"Construction and Repair of Commutators." By L. C. Sharpe. Twenty-nine 3½x6-inch pages, with 14 illustrations. L. C. Sharpe, Omaha, Neb. Price 50 cents.

Machinists who have electrical repairs to make and who find, as so many do, the commutator to be a puzzler, will thank the writer many times over for this unpretentious little book. It shows the operations of commutator making by a series of graphic sketches, and accompanies this with comments and precautions which make the procedure entirely plain. The book reprints most of the text and illustrations of an article from the author's pen which appeared in our columns for July 24, 1897, but a good deal of new matter has been added.

"Mechanics' Pocket Memoranda." By the International Correspondence Schools. 330 3¼x5¼-inch pages, with numerous illustrations.

This pocket book contains a well digested assortment of information. The usual subjects of the strength of materials, mensuration, logarithms, the mechanical powers, flow of fluids, etc., are clearly treated. A very useful chapter to many of deficient education is that on formulas, wherein the meaning and use of formulas considered as abbreviated rules are clearly shown. Considerable space is given to the proportions of machine details, and some very practical and condensed information on electricity is also included.

The book contains an insert fly leaf reading: "Compliments of the Cleveland Twist Drill Co.," and our copy comes from that source.

"Heat and Heat Engines." By F. R. Hutton. 553 6x9-inch pages, with 198 illustrations. John Wiley & Sons. Price $5.

This book is a survey of steam, hot air, gas and other heat engines considered as such. It begins with a presentation of the subjects of heat, combustion, fuels, draft, etc., and then proceeds with a discussion of the various classes of heat engines from the thermo-dynamic standpoint. The presentation of this subject is in a form which will meet the needs of a great many engineers better than any other with which we are acquainted. Of course, this subject is not capable of being treated in a "popular" way, and the equations presented cannot be called simple. At the same time they are not of the fearsome character usually found in discussions of this subject, and a free use of graphic methods and diagrams greatly assists in making tangible one of the most intangible of subjects. While he will occasionally have to accept a statement upon authority, it is, nevertheless, true that the reader may here obtain that comprehensive and intelligent knowledge of this science which many desire, but which they have been heretofore debarred from obtaining, more readily than through any other avenue of which we have knowledge. The production and use of compressed air are treated at considerable length, and the formulas deduced are those which are needed in connection with compressed-air work, and, moreover, they are in convenient form for actual use. The reader should understand the meaning of the operations and symbols of the calculus, but he will not find expertness in the handling of calculus operations necessary for an intelligent reading of the text. In

(*Continued on page 38.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Rawhide, fibre and hard rubber gears. The Arthur Co. (See page 8.)

Construction and repair of Commutators, 50c. L. C. Sharp, Omaha, Neb.

Fountain blueprint brush mailed, $2. Edw. A. Osse, 134 S. Charles st., Baltimore, Md.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1; post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Experienced draftsman, graduate, having shop experience. Box 297, AMER. MACH.

For assistant supt., master mechanic or chief draftsman, address Box 269, AM. MACH.

Experienced foreman on engine and general machine work; up-to-date methods. Box 310, AMERICAN MACHINIST.

An experienced foreman on engines and general machine shop work desires position. Box 314, AMERICAN MACHINIST.

Mechanical engineer, member of A. S. M. E., with 10 years' practical experience, wants position. Box 294, AMERICAN MACHINIST.

Party with machine shop and drafting room, general supervision of details and management of labor, desires a situation. Box 1429, Boston, Mass.

A sober man of 15 years' experience would like a position as foreman of a building shop by January 1; can give good references. Box No. 23, High Point, N. C.

Foreman Pattern Maker.—Position wanted by an experienced foreman pattern maker, on light or heavy work; can give best of references. Box 300, AMERICAN MACHINIST.

Wanted—Position as superintendent; am successful as systematizer and cost reducer; conversant with first-class shop practice; good references. Box 315, AMER. MACHINIST.

Mechanical engineer, well up in practical works management, foundry, machine, boiler shops; 15 years superintendent; large commercial experience; speak Spanish; wish change. Box 305, AMERICAN MACHINIST.

Position wanted to sell American machinery and to establish agencies throughout continental Europe, by engineer with large acquaintance and experience, and now living in Europe. Box 298, AMERICAN MACHINIST.

Wanted—Position, by competent man, as superintendent or manager of shop manufacturing light or heavy machinery or engine and pump work; best of references can be furnished. Address Box 299, AMER. MACH.

Wanted—Position as superintendent or assistant, by a practical machinist, with experience, judgment and executive ability; familiar with modern shop practice, improved tools and cost reduction. Address Box 313, AMERICAN MACHINIST.

Draftsman, designer and practical mechanic of 14 years' experience desires situation as assistant superintendent or chief draftsman; has held responsible position for the past 6 years and wishes a change. Address Box 306, AMERICAN MACHINIST.

Mechanical engineer and draftsman, familiar with the calculation and designing of gas compressors and steam engines, gas liquefaction (CO_2, NH_3, SO_2, etc.), ice and refrigerating plants, wishes to change. Box 309, AMERICAN MACHINIST.

By practical mechanic, age 47; experienced in tool work and manufacturing, also as foreman of tool-room and as general foreman of from 10 to 100 hands; familiar with fine work and reliable. Address "Connecticut," Box 311, AMERICAN MACHINIST.

Factory superintendent wishes change; is thoroughly up to date in modern methods of producing interchangeable work at low cost; good executive ability, good draftsman, and expert in designing labor-saving tools and machinery. Address Box 307, AMER. MACH.

Mechanical superintendent with 15 years' experience on light manufacturing, small interchangeable work, tools, jigs and fixtures, desires change; recently superintendent of a well-known make of typewriter; A1 references. Address Box 312, AMER. MACHINIST.

Energetic, capable young American mechanical engineer, with executive ability, technical education and 9 years' varied experience, desires change; am expert draftsman; speak English, German and little Spanish; have held positions of chief draftsman and manager. Address Box 280, AM. MACH.

Young man of thorough experience in the application of up-to-date methods, having wide and practical knowledge of cost-reducing tools, jigs, etc., automatic and hand screw machine product and general machine construction, at present holding responsible position, open for position as foreman or assistant superintendent; can furnish good references. Address Box 308, AMER. MACHINIST.

Help Wanted.

Wanted—A mechanical draftsman on printing machinery. Box 291, AMER. MACH.

Several machinists and molders; one tool

(*Continued from page 37.*)

other words, those, of whom there are so many, who remember the outlines and the philosophy of the calculus but who are no longer able to make actual use of it, will find themselves able to read the text with satisfaction.

To Pension Employees.

The pension system which the Pennsylvania Railroad Company is proposing to establish must attract general interest among both employers and employees. The system when established, it is estiated, will cost the company $300,000 per year. The age of seventy years has been fixed upon for compulsory retirement, but all employees after thirty years of service will be entitled to the benefits of the fund, the pension allowance being based upon length of service and the average wages received.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(89) J. I. B., Ensley, Ala., says: In shading the lower and right-hand lines of drawings I have been taught that when these lines are the boundary lines of cylindrical surfaces they should not be shaded; but I have noticed that on nearly all drawings, including those published in the "American Machinist," these lines are shaded just as other lower and right-hand lines. Which way is correct, the one I have been taught or the one I find in practice? A.—The original idea of the purpose of shade lines was that they are used to define the intersections of surfaces, one of which is in the light while the other is in shadow, and from this point of view the boundaries of cylindrical surfaces should not be shaded. This view of the case, however, leads logically to many absurdities and anomalies, and to follow it strictly would introduce confusion into drawings. On this account we, in common with most others, have abandoned this idea of their purpose, and regard them as simply a conventional device for defining the lower and right-hand edges of the pieces shown, thereby distinguishing at a glance between overlapping pieces and flush surfaces, and showing without reference to other views whether certain lines belong to elevations or depressions. From this point of view the boundaries of cylindrical surfaces should be shaded. The only defense for the use of shade lines at all is that they add to the clearness of drawings. If the logic of the plan which you were taught is followed to its conclusion the result is not added clearness, but obscurity. You will find the subject discussed at length in an article entitled "The Use of Shade Lines on Drawings," published in our issue of March 11, 1897.

Help Wanted—Continued.

maker, engine work; York State. Address Box 292, AMERICAN MACHINIST.

Two or three first-class draftsmen on engines, hoisting and general machinery. The Bucyrus Co., South Milwaukee, Wis.

Wanted—An orderly tool-room care-taker, to keep tools ground and in order; references, age, experience and wages. Box 293, AMERICAN MACHINIST.

Wanted—Good, all-round machinists on new and repair work; state age, experience and wages wanted. The Beall Machine Co., Cumberland, Md.

Experienced draftsman wanted for out of town; in making application give full particulars of past employment, age and salary expected. Box 318, AMERICAN MACHINIST.

Wanted—Experienced draftsman to work on cotton machinery; good position for an A1 man; state experience, references and salary expected. Address Box 317, AMERICAN MACHINIST.

Tool-makers.—Wanted, at once, three first-class tool-makers with experience on drill jigs, mill fixtures, forming tools, etc., for fine work; permanent positions and good wages for A1 men. Address "Tool-maker," care AMERICAN MACHINIST.

Draftsman wanted; must be a competent man, familiar with modern machine-shop practice and capable of general machine designing, under instruction; a permanent position is open to the right party. Address Box 316, AMERICAN MACHINIST.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite applications from draftsmen, pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Superintendent, capable and energetic man, thoroughly experienced in factory practice; knowledge of the principles of electricity desirable, but not essential. Address "Manufacturer," care AMERICAN MACHINIST, stating experience, age, references and salary expected.

Assistant foreman wanted in one of the best tool-rooms in the United States; fine position for a man between 28 and 40 years old, with experience on high-grade work and in handling men; only such need apply. Address "Assistant Foreman," care AMERICAN MACHINIST.

Wanted—Salesman; must have had practical experience in all kinds of heat transmission by steam and feed-water heaters, radiators, condensers, evaporators, coolers, etc.; furnish references as to capability, character and experience; state salary expected. The Heat Transmission Co., 28-38 Maple ave., Danbury, Conn.

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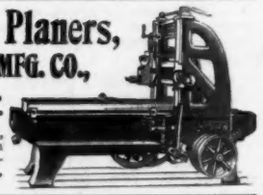

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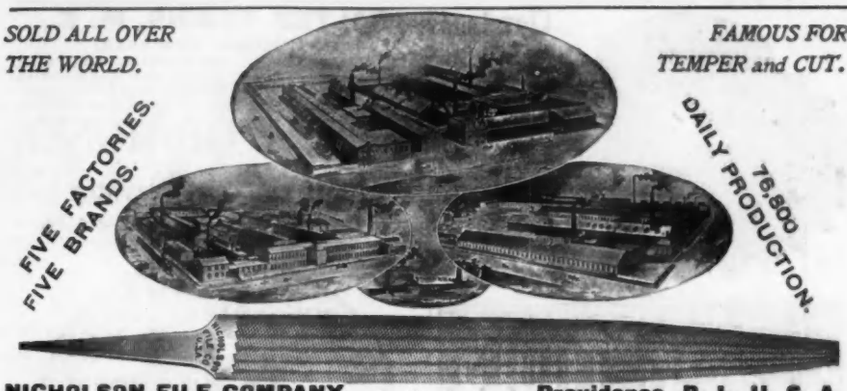

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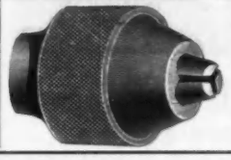

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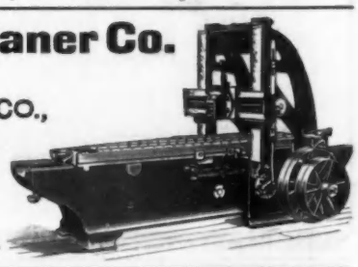

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The Junior Mechanical Engineers.

The monthly meetings of the Junior Members of the American Society of Mechanical Engineers are to be held at the rooms of the society, 12 West Thirty-first street, on the first Tuesday of each month from October to April, inclusive, and omitting December, when the annual meeting occurs. The first meeting occurred the present week, the paper of the evening being by Mr. Henry E. Longwell, upon the Westinghouse gas engine. We hope to see these meetings highly successful.

Personal.

Mr. C. P. Wetmore, who for several years has been foreman at Blake & Johnson's, Waterbury, Conn., has accepted a similar position with the F. B. Shuster Company, New Haven, Conn.

Charles Churchill, of the firm of Chas. Churchill & Co., Ltd., London, importers of American machine tools, will leave England on the 7th inst., arriving here about the 14th. During his stay in this country his business address will be care of Hance Bros. & White, 61 Maiden Lane, New York.

Obituary.

Jacob C. Cramp, the fourth son of William Cramp, the shipbuilder, died September 29, sixty-four years old. William Cramp started the shipbuilding business for himself in 1830. In 1857 his two eldest sons were taken into partnership, and in 1862 the other three sons were admitted to the firm, each member of the firm performing some distinctive and important work in the business. Eight years ago the business passed into the control of a syndicate of New York capitalists and all the sons except Charles H. retired.

It will be remembered that in our issue of August 24 we illustrated and described an eight-spindle adjustable drill made by Foote, Burt & Co., Cleveland, Ohio. Since that time they have built a machine similar to it, but with four spindles only, having a similar range of adjustment in all directions for the four spindles. With this smaller machine four holes may be drilled simultaneously in a straight line or staggered in any spacing from 2⅛ to 36-inch centers.

Manufacturers.

Ground was broken lately in Sag Harbor, L. I., for an addition to the Fahys watchcase factory, to cost $10,000.

The Warwick Iron & Steel Company, Pottstown, Pa., will erect a blast furnace near the company's present furnace.

Plans and foundations for the mill that is to be erected for the Diamond State Steel Company, at Wilmington, Del., are being rapidly developed.

The Standard Underground Cable Company

has purchased a site at Perth Amboy, N. J., on which to erect a plant to cost $200,000. Ground will be broken within four weeks, and the plant will be completed by next spring.

The name of the Stover Novelty Works, Freeport, Ill., has been changed, and will in the future be known as the Hoefer Manufacturing Company. Messrs. F. W. Hoefer, A. G. Hoefer and E. A. Hoefer are the incorporators.

The Morris (N. J.) Tablet Machine Company, capital $250,000, filed papers of incorporation recently to manufacture laboratory machinery. The incorporators are Charles W. Bailey, Philadelphia; J. Walter Douglass, Philadelphia, and George H. B. Martin, Camden.

The Hendey Machine Company, Torrington, Conn., is about to add to its shops by the building of a foundry nearly 200 feet long. This decision has been brought about by the unusual foreign, coupled with the domestic, demand for the company's machine tools.

It is reported that the firm of William Gardam & Son, of No. 45 Rose street, New York, manufacturers of machinery, will build a factory in New Orange, N. J. It is said that the factory will be 250 by 200 feet in size, and that work will be begun at once on its erection.

The Bullard Machine Tool Company, of Bridgeport, Conn., has let the contract for erecting a new blacksmith shop, 40 feet wide and 60 feet long. The side walls are of brick, and the roof trusses have a clear span and are made of steel. The Berlin Iron Bridge Company, of East Berlin, Conn., has the contract for the entire building.

New Catalogs.

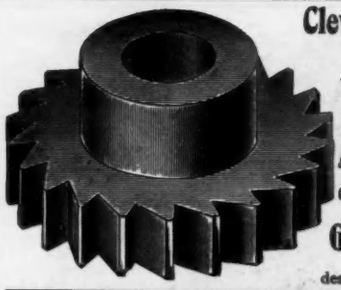
We have received from the Dexter Folder Company, Pearl River, N. Y., copy of catalog illustrating and describing paper folding and feeding machinery. The catalog is standard size, 6x9 inches.

We have received from Wm. Cox, 216 Murray street, Elizabeth, N. J., a circular giving a full list of his well-known mechanical computers, which are beginning to receive the appreciation among engineers which they deserve. The circular is 6x9 inches, four pages.

We have received program of the recent gatherings held in connection with the fiftieth anniversary of the Austrian Engineers and Architects' Societies at Vienna. The program, which is printed in the German language, contains names of delegates in attendance, and also letters of greeting from kindred societies. It contains 104 pages.

The Hoppes Manufacturing Company, Springfield, Ohio, sends us new catalog, in which are illustrated several of the company's specialties, particularly its steam separators and oil eliminators. These separators are made both vertical and horizontal. The various functions of these devices are described very carefully. The catalog is standard size, 6x9 inches.

Whiting Foundry Equipment Company, Harvey, Ill., has issued a catalog devoted to the illustration of cranes and air hoists. The catalog, although confined more particularly to electric and compressed air cranes, describes other types of jib, pillar and traveling cranes. The various points about the cranes are described in detail and a considerable number of half-tone illustrations showing parts and complete machines, are included, which assist greatly in understanding the mechanical points. Illustrations showing interiors of foundries where these cranes have been installed are given. The catalog contains 100 standard size, 6x9-inch, pages, and a copy will be sent to all interested upon application.



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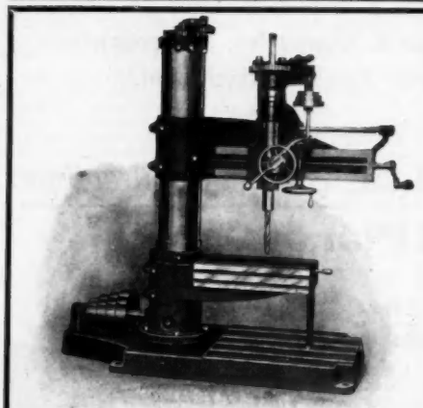

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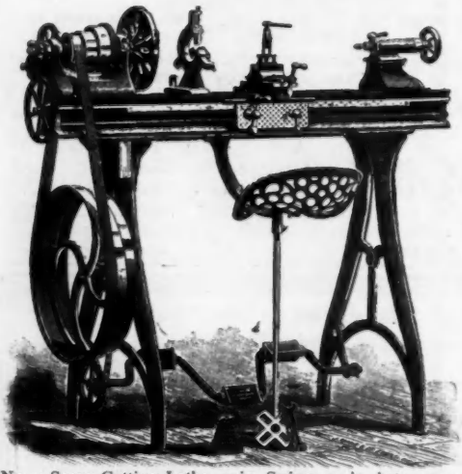

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